Entanglement and Interdigitation as principles of modern Digital Scholarly Editions

Verschränkung und Verzahnung als Prinzipien moderner Digitaler Editionen

Harald Jele

The release of the "Klagenfurter Ausgabe Robert Musil" was published in 2009 as a digital scholarly edition, created with the software Folio Views and delivered on DVD. This version can only be used on a single-user desktop with a Windows operating system. During the last years considerable developments have been established to migrate this comprehensive edition into a completely new environment of technologies, according to contemporary technical conditions and the changing needs of the end-users.
During the planning of such a change, building a web presence via an online portal was not defined as the main objective – although this is quite often the case and one of the former goals in similar projects. Preparing e-books as individual parts of the whole edition and the printing of congruent books were rather seen as a first step in the migration process.
Since e-books essentially lose the nexus to their source after delivery, a kind of "entanglement" was introduced to make subsequent changes possible. This is intended to ensure that modifications in the source files can be updated in the already supplied e-books, if necessary. Such a mode could be important in the planning phase as well as during normal everyday work, when editors revise certain content and adapt previous decisions.
In the chosen procedure it was also taken to ensure, that the individual media (the e-books as well as the printed works) is created in a way, closely linked to an upcoming, future online portal. This fact may be important, since the complete edition will only be available online. In all other media only indicators for further information are available, realized through a close interdigitation of content and functions within the edition. The indicated, additional information can be obtained directly through special links.

Die "Klagenfurter Ausgabe Robert Musil" erschien 2009 als digitale Edition. Sie wurde mit der Software Folio Views erstellt und auf DVD ausgeliefert. Benutzt kann diese Version ausschließlich am Einzelplatz mit einem Windows-Betriebssystem werden. In den letzten Jahren wurden Anstrengungen unternommen, diese umfangreiche Edition technisch völlig umzustellen und den zeitgemäßen Technologien entsprechend, neu zu realisieren.
Bei der Planung einer solchen Umstellung wurde jedoch nicht, wie vielfach üblich, die Erstellung eines Web-Auftritts über ein Online-Portal als wichtigstes Ziel definiert. Vielmehr wurde die Erstellung von Werkauszügen in Form von E-Books und dazu übereinstimmenden Druckwerken als ein erster Schritt im Migrationsprozess angesehen.
Da E-Books im Wesentlichen nach ihrer Auslieferung den Konnex zu ihren Quellen verlieren, wurde eine Art "Verschränkung" vorgesehen, die nachträgliche Änderungen möglich machen. Damit soll sichergestellt sein, dass Modifikationen in den Quelldateien (sowohl in der Aufbauphase wie auch im nachfolgenden Betrieb) in den ausgelieferten E-Books bei Bedarf nachgezogen werden können.
Im gewählten Prozedere wurde zudem darauf geachtet, dass die einzelnen Medien so erstellt werden, dass sie möglichst eng mit einem künftigen Online-Portal verknüpft sind. Dieser Umstand mag wichtig sein, da eine vollständige Edition nur online verfügbar sein wird. In allen anderen Medien sollen durch enge "Verzahnung" ausschließlich Hinweise auf Informationen vorliegen, die online möglichst ohne Umwege eingeholt werden können.

1 Introduction

During the last four years substantial developments have been established at the University of Klagenfurt's Robert Musil-Institute for Literary Research to redesign the digital scholarly edition „Klagenfurter Ausgabe Robert Musil". The edition was published in 2009, has been delivered since on DVD and was created with the software Folio Views.

Working on this edition startet in electronic form already in the 1980s. Since then, the individual processing steps (as the review and transcription of the author's manuscripts from the literary remains, the compilation of written texts, writing the critical annotations, the setup of registers for content indexing, etc.) have been continued steadily. As well as many other similar long-term projects, the history of this edition is characterized by a considerable number of technological and editorial breaks. In Fanta's (2011) article a survey of the historical development is provided, which outlines some of these specific breaks.

The decision to implement the edition in exactly this way resulted over the years into some serious drawbacks, which finally should be phased out by a complete redesign. The main disadvantages, inherently connected with this edition, are:

- runs exclusively on the Windows operating system,
- no multi-user mode available,
- no integration into a networked environment,
- limitation of the character set to Windows-1252,
- does not support editorial standards,
- does not support any of the important contemporary technical standards,
- uses a proprietary internal data format,
- provides only rudimental export functions, to process the data within other environments,
- no documentation for the markup of exported data,
- the exported data is not well-formed, an appropriate verification is not performed when exporting.

Considering only these technical aspects and comparing them with the current requirements of contemporary digital editions, the *Klagenfurter Ausgabe* could slightly be seen as a permanent prisoner inside a black box whose transfer into a modern system – but also the subsequent adaptation to contemporary standards – becomes quickly very complex and furthermore expensive (cf. Jele 2012).

Modern digital scholarly editions are currently mainly realized ("somehow") as an online application. Both, the searchable data as well as the data displayed, result usually from a certain repository and are stored in an (almost) standardized data format (like XML-TEI).

Sahle (2013, p. 55-57) identifies the following as the most important and essential features of a digital edition (almost as some of the main differences to a printed book), which can also be seen as their major advantages:

- elimination of any quantity limit,
- any restriction to an internal granularity (structure) is obsolete,
- expansion of the typographic representation,
- much more complex reference structures can be realized,
- taking multimediality into account,
- reduction of the barriers for publication.

The availability of an online form, as a specific feature of modern editions, is not mentioned separately in this context. But it is (of course) probably meant as an important and nowadays natural criterion. In any case, the possibility to add elements of collaborative work to a digital edition (as a commonly asked feature) can only be realized usefully, if the edition is available online (cf. Robinson 2009, par. 33). If these aspects are consistently taken into account during the whole planning phase, the idea of a digital edition, as, for instance, outlined by Boot and van Zundert (2011, p. 142), is clearly shown, when they describe the main changes during recent years as follows: "The move is from a desktop perspective of research towards a networked paradigm."

That the decision to create a digital edition exclusively in the form of an online application is the common, is evident both in the relevant literature and in the number of visible results: It is perceived (away from the intensive study at an expert level) who is online. Furthermore, in the literature but not intentionally in our case, and spoken with Robinson, print editions are obsolete. "Who would publish a scholarly edition in print, now that the digital medium exists?" (2010, S. 146). Also for Gabler (see. 2010, p. 48) publishing of printed works makes little sense, because the explicit focus of a contemporary edition lies mostly in the representation of its online form.[1]

Many of the properties mentioned above are already implemented as benefits of digital editions in the *Klagenfurter Ausgabe*. But nevertheless, it was decided, not to drive the redesign primarily into an online edition, but – rather opposed to the obvious trend – to produce in a first step several printings and e-books from the existing data. Thereby, the future online form and the printings are not seen in opposition to each other. The existing and maybe old-stylish digital edition is rather an intermediate step and a reasonable instrument to get in parallel to a well done printing. Such an edition can not and

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[1] The discussion "printing versus digital edition" is one that rapidly started with the emergence of digital works. The amount of essential and new results, which arised meanwhile, remained rather small. (cf. also Steding 2001, p. 155 and Thaller 2005, p. 220).

will not be created when considering completeness but primarily will provide reliable and easy citable prints.

The consideration to draw this decision traces back predominantly to the numerous responses of the edition users, who miss, as it seems, most of all texts (readers), which could be read and edited by them in their specific and individually different ways, separated from the large body of the edition in toto.

In the process of decision-making, which ultimately led to this procedure, an essential and important step was, that both the printings and their congruent e-books must be generated from an appropriate format, which also allows the successive development of an online application. Since the widely-used software packages, with which current digital editions are created online, tend to place a text encoding using XML-TEI, this specific coding form was chosen as the further origin format creating also the printed works and e-books.

Figure 1: The main components of a digital scholarly edition.

2 Entanglement

In addition to the typical characteristics of digital editions which have already been mentioned, it is one of the more important approaches for the redesign of the *Klagenfurter Ausgabe* to pay attention in particular to the aspect of "entanglement". This term is used here in the meaning as described in modern physics: The change of state of an *element A* at the *location 1* affects directly and immediately to the state of an *element B* at the *location 2*, although, between the two elements (in the meaning of classical physics) no obvious connection can be detected.

The question of an entanglement arises in the context of the redesign for the following reason: Are e-books once created in the course of the data migration process, and are they afterwards delivered through the traditional sales and distribution methods, they are, beginning at the moment of their delivery, for ever disconnected from the data source, and changes in there can not be delivered directly to the e-books anymore. This means, that the conventional distribution channels are always adverse for a digital edition, if (regularly) changes take place, or if those are already foreseeable (as they normally are). Both can be assumed for the *Klagenfurter Ausgabe*. Paying some attention to this fact is therefore quite relevant for choosing the further distribution channels.

Fig. 1 shows some of the essential components, that participate when creating usually a digital edition: The results of the single steps, when editing, are stored in a repository (of the editing system) by the person who is currently in charge ("REPO"). Each step is provided with a version / build number and should receive an ap-
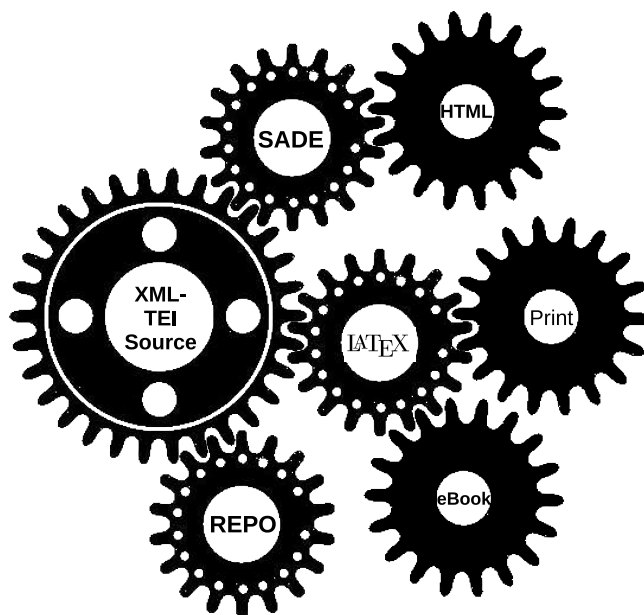
propriate quality control. Subsequently, those contents, which are to be published online, are taken from this repository and placed in that data source ("SADE"), from which the online application ("HTML") is supplied. The production of the prints ("Print"), as well as the identical e-books ("eBook"), happens in this case from the same source data ("XML-TEI"), from which the online application also generates its display.

Whether a change in the repository also causes a change in the displayed online edition, is controlled within the quality assurance by triggers. Is such a trigger set or even activated, the appropriate changes are taken from the repository, stored within the data source of the edition, as well as stored and indexed appropriately within the database. After this, the changed content is rather quickly available online and is also available to those processes, which are used for making the e-books ("LaTeX"). Is an e-book once delivered, this normally loses the connection to the sources, which originally maintained its compilation.

Metaphorically spoken, in the illustration of the interdigitated applications (*Fig. 1*) the corresponding gearwheel "eBook" looses the connection to the central transmission and receives no permanent drive anymore. In this (metaphorical) sense, e-books can only be seen as satellites of the edition, containing increasingly incomplete information and can not be reached for an essential update anymore.

With the approach of an *entanglement* of the individual media, this unfavorable situation should possibly be prevented.

In order to be able to deliver updates to e-books permanently, the approach was chosen, not to distribute them through the usual sales mechanisms (download or shipping via e-mail). Rather, those will be released

Ü̇BER DEM ATLANTIK befand sich ein barometrisches Minimum; es wanderte ostwärts, einem über Rußland lagernden Maximum zu, und verriet noch nicht die Neigung, diesem nördlich auszuweichen. Die Isothermen und Isotheren taten ihre Schuldigkeit. Die Lufttemperatur stand in einem ordnungsgemäßen Verhältnis zur mittleren Jahrestemperatur, zur Temperatur des kältesten wie des wärmsten Monats und zur aperiodischen monatlichen Temperaturschwankung. Der Auf- und Untergang der Sonne, des Mondes, der Lichtwechsel des Mondes, der Venus, des Saturnringes und viele andere bedeutsame Erscheinungen entsprachen ihrer Voraussage in den astronomischen Jahrbüchern. Der Wasserdampf in der Luft hatte seine höchste Spannkraft, und die Feuchtigkeit der Luft war gering. Mit einem Wort, das das Tatsächliche recht gut bezeichnet, wenn es auch etwas altmodisch ist: Es war ein schöner Augusttag des Jahres 1913. **[Abs. 1]**

Autos schossen aus schmalen, tiefen Straßen in die Seichtigkeit heller Plätze. Fußgängerdunkelheit bildete wolkige Schnüre. Wo kräftigere Striche der Geschwindigkeit quer durch ihre lockere Eile fuhren, verdickten sie sich, rieselten nachher rascher und hatten nach wenigen Schwingungen wieder ihren gleichmäßigen Puls. Hunderte Töne waren zu einem drahtigen Geräusch ineinander verwunden, aus dem einzelne Spitzen vorstanden, längs dessen **[Abs. 2]**

9

Figure 2: "Robert Musil: Der Mann ohne Eigenschaften." (Engl.: "Man without Qualities"). Detailed view of a page from the e-book. The entire copy can be viewed at the following link:
`http://wwwu.aau.at/hjele/publikationen/`
`2015_verschraenkung/ebook_musil_mann.png`

Figure 3: "Robert Musil: Der Mann ohne Eigenschaften." (Engl.: "Man without Qualities"). Detailed view of a page from the printed book. The entire copy can be viewed at the following link:
`http://wwwu.aau.at/hjele/publikationen/`
`2015_verschraenkung/ebook_musil_mann_print.png`

through the appropriate interfaces online into „App Stores" (like *iTunes* for devices from Apple, *Google Play* for devices with an Android operating system or *Windows Store* from Microsoft).[2] All App Stores listed here offer very comprehensive mechanisms to perform an upload automated with technical standard tools. Here we use the already given possibilities of the existing application programming interfaces (API = Application Programming Interface) from the various *App Stores*, which enable a comfortable communication with a comparatively little effort through *RESTful* technologies and which are widely offered as web services.[3]

When updating one ore more e-books, the essential procedure (rather independent of the particular *App Store*)

is always the same: An e-book along with its metadata is loaded once into the *App Store* ("by hand" in our case) and can afterwords be kept up-to-date automatically because of its unique identification, which is created through the first upload.

In the case of *iTunes* the usual metadata are:

- the e-book's name,
- the identifier (Apple's SKU Number = "Stock keeping unit"),
- a possible Bundle-ID,
- the date of publication,
- the price according to the given categories,
- the country names in which the file should be published.

For each version, which should be kept available within the *App Store*, the files must enclose the following information:

- the current version number,
- a copyright notice,
- a permanent allocated content category,
- data on age restriction,
- an icon 1024x1024px,
- max. 4000 characters description,
- max. 100 characters on key words,

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[2] The fact, that App Stores are used for the delivery of digital editions is, of course, not entirely new (cf. Siemens et al. 2012). New and perhaps also interesting is the relation in which the features of this extensive distribution method are placed here.

[3] The essential advantage of the just mentioned *RESTful* technologies compared to the other approaches (to update an e-book) is, that these can be done via simple *HTTP* requests. This also means, that in the most simple case a common web browser could almost be sufficient.

That *RESTful* technologies become increasingly important in the field of digital research environments (and therefore also within the Digital Humanities) can, for example, clearly by shown in the results of Tonne et al. (2013).

The following link shows abundantly the necessary information, in a gently merged, detailed annotated and well prepared way:
`http://www.programmableweb.com/`

- a support URL: „A URL that provides support for the app you are adding. This will be visible to customers on the App Store.“

If a user has purchased an e-book through one of the *App Stores*, he or she receives within his or her client, regardless of the device (which could be e. g. a notebook, tablet, handheld or even a smartphone), on which the user is currently working, an information about the currently performed update. Subsequently he or she can either download or reject this. If the individual versions, which sometimes could be quite different from each other, should stay accessible for the user, this is, according to our experience, better done within a separate and maybe an own web service. Regarding this specific function (keeping several versions online), the relevant services of the *App Stores* are generally difficult to understand, often somehow untransparent and actually much more designed to deliver in general new and up to date versions to the user, than to keep a comprehensive history of the delivered versions in stock.

3 Interdigitation

In the process of redesigning the *Klagenfurter Ausgabe*, e-books and their identical printed works must be seen as specially designed parts of an overall extensive edition, which can be joined to the whole mainly due to their functional design. All "parts", which could be integrated into the whole edition only with a series of difficulties and inconvenience appear rather inappropriate.

The term "interdigitation" is used here in the specific meaning, that the individual parts of the whole edition (and thus especially the e-books) are well coordinated to each other (regarding content and function), so that the information in the individual parts interlock almost without frictions.

For this reason, it was essential to consider, which information, present within the future online edition, should be taken into the individual e-books. Since printed works (and their congruent and identical generated e-books) are quickly confusing when drowning the readers with too much of additional information and their design becomes increasingly unclear, it was decided after plentiful testing, to reproduce (for now) only the reading texts within the e-books. But these will always be provided with a link to the online version, if there exists some additional information (for instance a comment, a further witness or a register entry) to a specific passage. In addition, a link to the corresponding position within the online edition was added to each paragraph of the e-book, realized as a *side note* within the margins of the printed text. This feature makes it possible to reach virtually any point of the e-books within the online edition
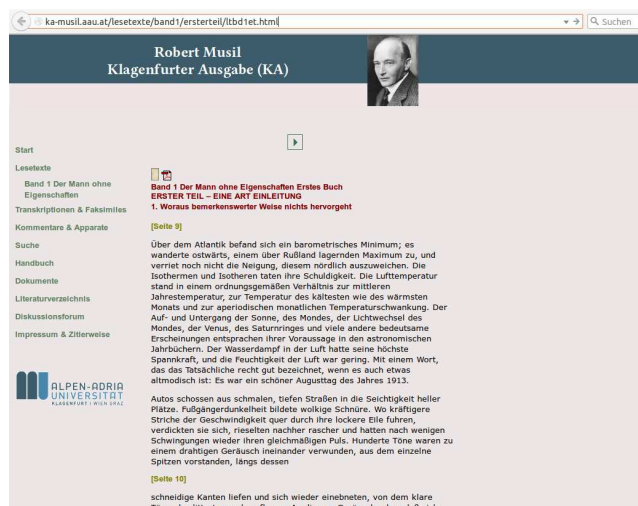

Figure 4: "Robert Musil: Der Mann ohne Eigenschaften." (Engl.: "Man without Qualities"). Detailed view of the same page from the online edition. The entire copy can be viewed at the following link:
`http://wwwu.aau.at/hjele/publikationen/2015_verschraenkung/screenshot_online_musil.png`

with a single click and to continue working on the same position there.[4]

Fig. 2 shows the relevant linking at the framed sections of the used e-book reader.

The issue of the specific production of the single e-books has essentially managed by opting for the appropriate output format by itself. Due to its non-binary text encoding and storage XML-TEI is a favorable output format for the computer aided processing, especially in those formats, which have the same or very similar characteristics. This is within the group of suitable typesetting programs especially true for LaTeX, which offers itself for the production of the printed works as well as for the e-books already because of that single fact. Appropriate XSL stylesheets to convert the texts (from XML-TEI to LaTeX) are already available and include most of the needed key features and certainly give a quick overview of the additional jobs, which have to be done during the conversion (see TEI-Consortium 2013).

The decision to use LaTeX for the production of the e-books and the printed books meets with the demands for a better print quality of Musil's works, which were made often, even in a different context. Metz (cf. 2014a und 2014b) analyzes the various editions of the works written by Robert Musil, which are mostly still available on the book market, due to their typographic design. He concludes that although these editions (and in particular the editions of the "Man without Qualities") are among the best known within the German literature, but they are (besides other reasons) at the same time, due to some lacks of the printing quality, among the least read. In this context he mentions the circum-

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[4] see *Fig. 4*, where the corresponding paragraph is shown within the online edition.

stances, that e. g. inadequate typesetting, a very unkind typographical implementation without considering aesthetic features, a much too dark gray value for each page, an inappropriate tracking of the printed lines, the neglecting of clearly legible fonts, and a lack of optical margin alignment degrade the text legibility dramatically. Especially the outstanding extend and the opulence on the various matters within the "Man without Qualities" requires an aesthetically pleasing reproduction, so that a potential reader does not break off in a listless printed bulk of pages and does not put the book aside and considers this matter as closed.

Since LaTeX is particularly famous for its aesthetically pleasing print image, it also appears, straight in regard to these (typographic) claims, to be the right and at the same time the best means of choice to satisfy this aspects.

When comparing *Fig. 2* and *Fig. 3* it is noticeable, that both versions (the e-book as well as the print edition) show the reading text congruently, in the same, ident way, but the setting of the print design of the two is rather different: The e-book contains some additional information, which distinctively improves its functionality. Whereas, the readability of the printed editions would be substantially disturbed by this. In order to realize the difference between the e-books and the printed works automatically, when compiling them, and concerning to keep the overhead as low as possible, we access here with standard Unix tools for patching and merging the single paragraphs within the various texts. Therefore we keep an additional patch file to every e-book. With those application every e-book (which always contents the enriched information) can be automatically reduced to the output of the appropriate print. Again, this is a circumstance, which in turn justifies the use of LaTeX.

4 Summary

E-books play a special role, when they are parts of a comprehensive digital scholarly edition:

On the one hand, they show feasible options, to prepare especially reading texts typographically in a way, that they appear aesthetically attractive and that they are implemented in a rather legible form. In addition, e-books are more suitable than online editions for an easy and less complex citing, when working academically. Also, the common mechanisms to process specific contents with further tools in an electronically way, are mostly easier to achieve within e-books, since these are mainly not linked to some extra and very specific functions (such as a data export or a proper behavior for printing). But within online editions these widely-used mechanisms must be taken into account and must be implemented almost separately.

Should in addition to the information, kept only in an electronic form, also some printed works be provided, the e-books must be created in a specific way, which allows the production of the (mandatorily) identical prints almost automatically and without much rework.

On the other hand, of course, it remains to consider, that a digital scholarly edition is subject to a constant change, so that its online publication reflects at any time (merely) the current instantaneous state. Certainly, this changes continuously and can differ substantially from the previous, depending on the degree of editing.

Considering the herein described aspects of an "entanglement" and a favorable "interdigitation" of the particular media, it can succeed to involve also e-books into a digital edition in a certain way, that a specific change in their functions and contents remains possible, even after their delivery. An important role in the entanglement of the single media take present technical interfaces, as the procedures outlined here by *RESTful* technologies, and the extensive use of the existing and widely known *App Stores*. With them, a high degree of automation, in the upload method and the subsequent delivery to the individual user, could be reached.

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Dr. Harald Jele
works at the University of Klagenfurt

Adresse:
Robert Musil-Institut
Bahnhofstraße 50
9020 Klagenfurt, Austria
E-Mail:harald.jele@uni-klu.ac.at