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COOPERATION TECHNOLOGY AND TIMELINESS OF INFORMATION: COMPARING TRAVELBOOKS, WIKIS AND ONLINE COMMUNITIES

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Abstract

Based on an information systems metaphor for virtual communities this paper discusses up-to-dateness as one crucial factor of travel information quality. Two empirical studies are presented which show that the up-to-dateness of information in travelbooks, wikis and in forum communities does not differ systematically. Based on this empirical evidence we focus on understanding the factors influencing the up-to-dateness of the three media. We propose a framework with three determining factors: 1) the initial up-to-dateness at the time the information is first available for the user 2) the information volatility in a certain domain and 3) the length of the revision cycles. From these factors we hypothesize a) that the initial up-to-dateness is best in travelbooks and worst in forums and b) that the revision cycle is shortest in forums and longest in travelbooks. Since wikis come close the initial up-to-dateness of travelbooks and its revision cycle is almost as short as in forums, we finally argue why we believe wikis to be the most up-to-date medium in the long run.

Keywords: virtual communities, information quality, up-to-dateness, tourism information

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[*] The authors appear in alphabetical order.

1   INTRODUCTION

Travelling has a tremendous impact on shaping beliefs and attitudes about our world. It is also a very complex endeavour, as many decisions have to be taken outside one's usual context. The internet and the increasing availability and portability of computers offer individual travellers new choices on how to gather the information necessary to make their journey a safe, enjoyable and educational experience. While they no longer are confined to professional guidebooks but also have access to user-generated content on the internet, uncertainty remains about the quality of this free information. In Schwabe & Prestipino [05] we proposed that information quality for tourists should be described using four factors: completeness, timeliness, personalization and structure. Completeness and timeliness have been covered in prior publications [Prestipino et al. 06, Prestipino et al. 07]. In all studies we take a user perspective, i.e., we analyze the quality of the information as it is presented to a user in typical travel situations. Such a user would use one of the most popular guidebooks, access the most popular forums and wikis, and ask typical travel-related questions.

This paper explores how up-to-date the information is in professional guidebooks, wikis and forums. In our framework paper we hypothesized that wikis are the best at providing timely tourism information and that guidebooks are the worst. In two sets of experiments (one published in [Prestipino et al. 07]) we found no significant differences among the three media when considering the media at the group level. While the equality of the three media may be an interesting result in itself, we tried to understand how media with specific structural differences could reach such a performance. This paper focuses on understanding the factors influencing the up-to-dateness of the three media.

2   TIMELINESS: LITERATURE AND EMPIRICAL RESULTS

2.1   Related literature

In Schwabe & Prestipino [05] we defined four dimensions of information quality based on the notion of a knowledgeable traveller. *Completeness* refers to the degree to which a medium is able to serve a user's information need, implicitly capturing other criteria, such as ease of understanding, and serving as an indicator for relevancy (for an empirical evaluation see [Prestipino et al. 06]). *Structure* refers to the presentation and structure of information, which may greatly affect efficiency of information access and learning, and it is therefore closely related to the criteria accessibility and understandability found in literature. *Personalization* indicates how fitting the information is for a person in her real world context, and how much unnecessary and unsuitable information is returned to her.

Finally *Timeliness* refers to whether information is up-to-date and available to the user in an acceptable timeframe. Timeliness is mentioned in most frameworks on information quality [Eppler 03]. Different terms are used for aspects of this concept. Bouzeghoub et al [04], for example, uses the term "timeliness" for the frequency of change and currency for the age of information. Eppler [03] uses "timeliness" for the ability of the system to deliver useful information in time and the term "currency" for the ratio between up-to-date and outdated information. In [Gertz 04] timeliness and freshness are aspects of currency, which is defined as „the degree to which recorded data is up-to-date". [Ballou 98] decomposes timeliness into "currency" and "volatility", the former being the age of the data and the latter describing the time span during which data are valid. [Rittberger 01] uses currency and timeliness as synonyms. While these different conceptualizations are often hard to integrate, they also lack, in many cases, concrete applications of the suggested measures for evaluations of up-to-dateness in information sources. Thus, auditing timeliness of existing information systems is an open research problem and is critical for management of information production [Bouzeghoub et al. 04].

2.2   Empirical studies

Design and summary of results of first study

In Prestipino et al. [07] we published a study which compared the up-to-dateness of printed travelbooks and wiki communities comparing one wiki with one travelbook. The up-to-dateness of information items was assessed by phone calls, e-mails or trustworthy webpages. The results of the first study indicated that the up-to-dateness of both media did not significantly differ from each other.

Design and summary of results of second study

In a second study we expanded the evaluation by assessing forum communities as well. Furthermore, we improved the rigor of our study based on our experience in the first study. The first study had shown that information from different categories (e.g., medical information and information about sports and shopping) differed with respect to up-to-dateness. The same holds for attributes which can be allocated to information objects (e.g., the price of a hotel room changes more often than the address of the hotel). Thus, an evaluation of up-to-dateness should only assess objects and attributes from the same category to ensure a fair comparison of the assessed media types.

We therefore confined our study to two information objects evaluated in all three media types. The key was to find object categories which were crucial for independent travellers with respect to up-to-dateness. Accordingly, we published online surveys asking for aspects which – in case of out-of-dateness - were experienced as most annoying during travelling. Links to this survey were published in well-known travel communities (e.g., the Thorn Tree Forum). These surveys resulted in a ranked list of objects (like addresses of hotels, prices of restaurants etc.). We took the objects which were ranked high on this list and checked if sufficient items could be found in all six media to reach sufficient test power. These selection criteria resulted in two object attribute combinations: prices of accommodations as well as the name and address of restaurants.

To rule out that the results of our evaluation would only arise from the selection of a specific medium, we decided to assess two media for each media type. For the printed guidebooks we selected the well known "Lonely Planet" travel guide and the "Moon Handbook" published by Avalon Travel Publishing, one of the biggest independent travel publishers in the United States. Both editions were almost one year old at the time of evaluation[1]. As the typical revision cycle of popular travel guidebooks is two years, these editions represent the information in a form that is typical for the average traveller. For online forums, we selected the popular Thorn Tree Forum run by Lonely Planet as well as the Virtual Tourist Forum. For wikis, we selected World66 and Wikitravel which are, at the time of writing, the biggest free travel wikis on the net, and set up for a global audience. To rule out that differences between different regions of the world would influence our sample, we confined the study to one popular country for independent travellers, namely Australia.

We collected 45 accommodations and 45 restaurants from each of these six media resulting in a total number of 540 information objects. In the case of travelbooks and wikis, these objects were chosen randomly. For travelbooks, a page number was drawn randomly and then from this page number, the next paragraph with accommodations was selected; from this group of accommodations, one object (like a hotel or youthhostel) was selected randomly again. For the wikis, a page covering Australia was randomly selected. If the page contained accommodation, one was selected randomly. For the forums, we took the perspective of a user who would use the keyword based search with terms like "hotel" or

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[1] The Lonely Planet Travel Guide was published in Nov. 2005, the Moon Handbook was published in Oct. 2005. The evaluation took place in Aug./Sept. 2006

"hostel" for the area of Australia. Then we selected the first 45 accommodations with price information. This same procedure was also carried out for the restaurants.

After the collection of the sample the information was checked by e-Mail, phone or web-pages of the respective accommodation or restaurant. Information on web-pages was only considered trustworthy if it clearly belonged to the respective institution and if clear dates were published in the time span that the prices were valid. In all cases of doubt the institutions were contacted by e-Mail or phone.
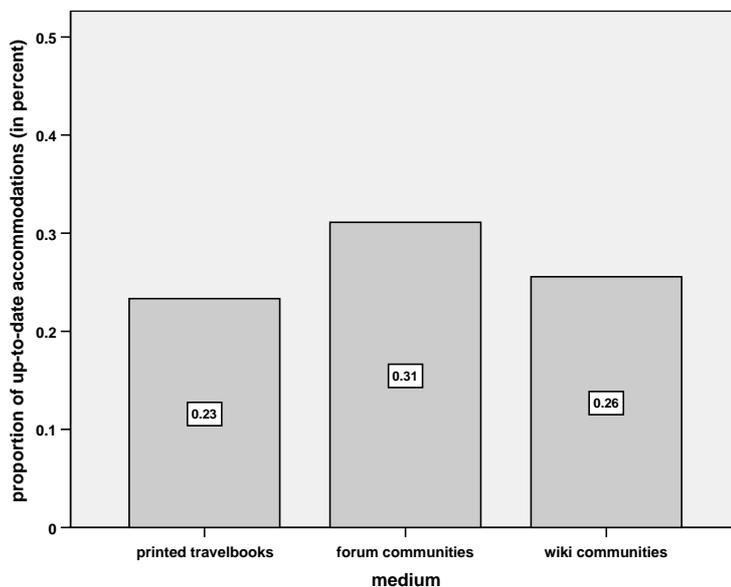

Figure 1: Proportion of up-to-date accommodations for the three media types

Figure 1 shows the proportion of up-to-date accommodation. All prices in the media which matched the actual prices were categorized as up-to-date, while all prices with deviations were categorized as not up-to-date. As predicted by our hypothesis, the forum communities show a higher percentage of up-to-date accommodation than the printed travelbooks. This difference, however, does not reach significance. A binary logistic regression over the three media types shows that the differences are not systematic (omnibus chi-square = 1.46, df = 2, p = .481). Other measures for accommodations, like the deviations of the actual prices from the prices in the media, show similar results.

The results for the restaurants correspond to a large extent to the results for accommodation on the level of the three media types. The percentage of up-to-date information is higher for all six media since the addresses and the names of restaurants change less often than the price of accommodation. Thus, five media (the travelbooks, the forums and one wiki) all had up-to-dateness values above 90% percent. No significant difference was found between these five media (log. regression: p = .68). However, there was one exception: the wiki community World66 reached only a level of 56% of up-to-date information objects. We believe that one person entered a number of restaurants when the wiki was started and the respective page had not been updated. This shows that the variance in communities is higher than in guidebooks. If the activity is low in certain areas of the wiki information happens to get out of the zone of attention and will not be updated.

While we did not find systematic differences between the three media types, there were interesting differences within the media itself, particularly between the two travel forums. This motivated us to look closer at the technical and social construction principles of the media. The next sections introduce a model of these construction principles and will use the model to show why the differences are currently insignificant and provide justification for why we propose that, in the long run, wikis will be the most up-to-date. In this discussion we include data on up-to-dateness of each individual medium.

3   FACTORS DETERMINING UP-TO-DATENESS

We propose that there are three main factors which influence the timeliness of information in all three media: 1) the initial up-to-dateness at the time the information is first made available to users, 2) the speed at which the referred information changes in a certain domain (volatility), and 3) the revision cycle of the information. The overall up-to-dateness of an information item in a guidebook can be described by a zigzag-curve. With each revision cycle, the information up-to-dateness starts at a height determined by the initial up-to-dateness and then degrades with the volatility of the domain. The revision cycle determines when the item's up-to-dateness is again lifted to the initial level of up-to-dateness. The next sections will further describe and decompose these factors. We use the traditional guidebook to introduce the factors and discuss the instantiations in forums and wikis in the hypothesis section.

1) The initial up-to-dateness at the time the information is available for the user

The initial up-to-dateness is a function of the quality of the information production process: The faster and more reliable that information is made available to the user, the more up-to-date the information will be. Thus, initial up-to-dateness is influenced by: a) the quality of the the observation of the source information, b) the speed of the externalization of the information, and c) the publication speed.

The **quality of the observation of the source information** covers the capability of the author to collect true data. There are two general sources for out-of-dateness: the information is observed incorrectly (e.g., someone asks for an address and memorizes the wrong house number). In this case we have incorrect information from the start which would later appear to be outdated. Second, the information is not observed directly but is taken from an existing source, for example, an outdated webpage. In this case, the entire life cycle from the original observation of this information would need to be added to the current process which would, of course, increase the probability of this information being outdated.

The **speed of the externalization of the information** refers to the time-span between the last observation until the information is put down for publication. In the case of a printed guidebook, this would be the time span from the inquiry by an author until the moment at which she delivers her page proofs to the publisher.

The **publication speed** refers to the time span between the externalization and the moment at which the information is available to the customer. In the case of the printed guidebooks, all efforts to lay-out, print and distribute the guidebook to the bookshops are within this time span.

2) The speed of change of the referred objects in a certain domain (volatility)

As pointed out in section 2.2, the objects of different information categories, as well as their attributes, differ decisively with respect to up-to-dateness. Extreme examples would be weather conditions or the possibility to do a trip when a certain number of persons are needed. The probability of information being out of date after a certain time obviously increases with a rising speed of change in the source. The three media types presumably adjust to this effect by selecting information suitable for their revision cycle (i.e., a guidebook would not publish special offers of a restaurant since they would probably be outdated by the time of publication).

3) The revision cycle

The factor which counteracts the speed of change in the domain is the revision cycle of the medium. The revision cycle depends on: a) the flexibility of the medium ("how easy can the medium be changed"), b) expected quality barriers, and c) the activity potential.

The **flexibility of a medium** refers to the effort an author has to apply to manipulate the information in the medium. The printed editions of travelbooks are rather inflexible since every change has to go through an elaborate and expensive process of editing and then the changed information has to be

printed. The publisher himself can decide upon changes, but still depends on the edition cycle to see his revision realized. Thus, there are two factors influencing the flexibility of a medium: technical constraints and economic constraints. While the new release of a guidebook after every relevant change in the domain might technically be possible, it would not be feasible from an economic point of view.

Expected quality barriers refer to the expectations of an author concerning the level of quality his delivered information must have in order to be accepted in the medium. This level of quality can refer to the thoroughness by which the information was researched (how certain an information supplier is that the information is correct) as well as to the level of refinement that the information has to have in order to be accepted (e.g., language, consistency, structure).

The **activity potential** describes how many contributions the sum of all users are willing to make. This depends on the popularity of the medium (determining the sum of all users), the incentives for contributing and the individual's willingness to contribute. The actual number of contributions will then be a function of the potential activity, the expected quality barriers and the flexibility of the medium. In the case of the guidebook, the activity level is mainly determined by the number of the professional authors and to some extent by the number of users who give written input.

Finally, the average up-to-dateness of an information item an average user receives when accessing information can be calculated as follows: Up-to-dateness at user access time = initial up-to-dateness minus decrease of up-to-dateness due to outdating of information (du).

In the following calculation we assume that user access behaviour is stable over time. This assumption is plausible, as the demand for travel information is not determined by the offer, but rather by the desire to travel. In contrast to the purchase of other literature, travellers do not buy a travelbook because a new edition appears but because they plan to travel to a certain country. (du) can be calculated as follows for information items in guidebooks:

$$du = 1/2 \text{ revision cycle in days} * \text{outdating per day due to domain volatility}$$

The calculation of the up-to-dateness of wikis is the same as for books on an item level. While in books all information items go through a revision at the same time, each wiki information item may be changed in isolation. The formula is the same for forums, but the calculation of the revision cycle is a little more complicated: Here the user has two ways of accessing information: 1. She can pose a question and receive the answer. In this case, she receives newly created information and thus the revision cycle is so fast (= the time, she waited for the answer), that it can be neglected. 2. Or she accesses the information from the community archives, e.g., because she does not want to wait for the answer. The revision cycle of forums therefore is the probability that the user access the archives multiplied with the revision cycle of items in the archive. A revision cycle in a forum is the average time until a new thread provides the same information as a prior thread. Note, that our model does not cover the case, that an information item sought by a user is not available in a medium. This is an issue of completeness, not up-to-dateness.

4   HYPOTHESES

This section presents the hypotheses on the comparative up-to-dateness of printed guidebooks, wikis and forums. We present hypotheses on three levels of detail with 1 representing the highest and 2 the lowest. On a very general level, we reiterate why we think that wikis will have the best up-to-dateness – at least in the long run. As shown in section 2, our empirical data does not yet support this hypothesis. On a medium level, we argue that the current comparatively good up-to-dateness of travelbooks depends on the initial up-to-dateness, and the comparatively good up-to-dateness of forums depends on the speed of revision. On a detailed level, we will argue that while publication speed is slowest in guidebooks, the initial up-to-dateness is mainly determined by the quality of observation as well as the speed of externalization. Here, printed guidebooks are currently the best.

	travelbook	wiki	forum
H0: Overall up-to-dateness (sum H0.1)	**2/3[2]**	**1**	**2/3[3]**
H1: Initial up-to-dateness (sum H1.4)	**1**	**2**	**3**
H1.1: Quality of observation	1	2	3
H1.2: Speed of externalization	1	2	3
H1.3: Publication speed	3	1	1
H2: Revision Cycle (sum H2.4)	**3**	**2**	**1**
H2.1: Flexibility of the medium	3	2	1
H2.2: Quality barriers	1	2	3
H2.3: Activity potential	3	2	1

Table 1: Summary of the hypotheses
Numbers = rank order; 1: highest; 3: lowest Grey: dominating variable

The revision cycle is mainly determined by the activity level and the flexibility of the medium which, in turn, favours forums. We propose further that domain volatility is important for the choice of an appropriate medium, but is only a constant factor influencing all media in the same way. Table 1 summarizes the hypotheses. Thus, the information in a medium is depending on the initial up-to-dateness, the domain volatility and the revision rate. Our model can be reformulated as hypothesis H0:
H0: The information in a travel medium is the more up-to-date, the better the initial information is, the lower the domain volatility is and the higher the revision rate.

The next sections will decompose H0 and propose detailed factors determening initial up-to-dateness and revision rate. We will not decompose domain volatility into specific hypothesis, because we assume that it is equal for all three media. Those detailed factors are now sufficiently specific to formulate hypothesis that rank travelbooks, wikis, and forums. As electronic media are changing rapidly, the rankings are only valid for the foreseeable future. We will then strive to aggregate those rankings to a ranking of the three medias' initial up-to-dateness and revision rate and finally to the three medias summative up-to-dateness. As we have to make assumptions on the strength of the individual factors, the aggregated hypothesis does not claim to have the same validity as the detailed hypothesis.

1) Initial up-to-dateness
Based on our model we also propose:
H1: The initial information is the more up-to-date, the better the quality of observation is and the faster externalization and the publication are.

The next sections will look at each of the factors determining initial up-to-dateness.
a) Quality of observation

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[2] depending on volatility
[3] depending on volatility

In the case of printed guidebooks, the observation or the inquiry of travel information is done by professionals who follow a systematic plan. They have often had a long lasting working experience with the domain during the process of investigating information. Their activity is clearly focused on the observing and writing process, and having numerous errors can clearly be harmful for their professional reputation. Travellers who enter information into a wiki usually do not travel mainly to gather information, but it will often be a mixture of recreation, fun and education. Even though a certain peer pressure should not be underestimated, users do not have to face personal consequences if the entered information is erroneous. Sometimes information might also be consciously gathered to be entered into a wiki. In a forum, however, the entering of information is query driven. A question is posted and users answer the question, often from memory. This will, in many cases, be information they did not gather with the intentional to pass it on to others. Therefore, we assume:

H1.1: The quality of observations is best in printed guidebooks, second best in wikis and worst in forums.

b) Speed of externalization

Since the publisher knows about the importance of his travel information being as up-to-date as possible, he will shorten the time between the inquiry of the information and the "ready for print" state. He will request his authors to deliver new information in as short a time period as possible before the new edition. In open virtual communities, information production is not managed and no deadlines have to be met, so the time between the observation and the entering of the information can be much longer. In discussion based forums, the speed of externalization is also heavily dependent on other users asking a question. Only then will the available knowledge of the community be externalized, which may be long after the observations have been made by the writers. Some users solve this situation by posting information that was not asked for in the forum [cf. Prestipino 04]. In a wiki, a user can immediately find an appropriate place to put his observed information, so the time of externalization is more dependent on his motivation. We conclude that:

H1.2: The Speed of externalization is highest in printed guidebooks, second best in wikis and worst in forum.

c) Publication speed

As pointed out, the publication speed is the time span between the moment when the information is ready to be printed or posted and the moment it is available to the intended audience. The printed guidebook is obviously much slower than the communities in this process since the books need to be printed and distributed. A typical forum or wiki software available on the internet will transmit content immediately to the server(s), where it will be published to users of the system.

H1.3: The publication speed is equally high in forums and wikis, and decisively lower in guidebooks.

The publication process of a book may take a few weeks or even months, while changes to wikis and forums happen instantaneously. However the externalization of knowledge in travel wikis and communities typically is one dimension longer (months to years) with currently observed user behaviour. Thus the information is most up-to-date when published by a guide-book. As forums require an external trigger (the question by another community member), externalization will even take longer than with wikis. A ranking of guidebooks as having the best initial up-to-dateness and forums having the worst is further supported by the rankings of the initial up-to-dateness. Thus, our summative hypothesis on initial up-to-dateness is:

H1.4: The dominant factors are quality of observation and speed of externalisation. Therefore, the overall initial up-do-dateness is highest in printed guidebooks and lowest in forums.

2) Revision Cycle

From our model we conclude:

H2: The revision cycle of a travel medium is shorter, the more flexible the medium is, the lower the quality barriers are and the higher the activity potential of a medium is.

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a) Flexibility of the medium

In a forum the space of information can be changed quite easily by posting or answering a natural language question. A wiki proposes higher barriers since it requires the use of a simple editing language. A guidebook can be changed only with considerable effort since a re-print of the entire book is necessary to update single information items. Therefore, we assume:

H2.1: The flexibility is highest in forums, second highest in wikis, and lowest in guidebooks.

b) Quality barriers

Queries for a forum can be posted in natural language and are usually held in a colloquial style. Thus, the effort for the reader to explicate his information need or his knowledge is comparably low. Wikis already have decisively higher standards. Information needs to be wrapped into a consistent text and requirements for formal and stylistic aspects of language are higher. Guidebooks whose financial success is also dependent on the quality of the information presentation need to follow even higher standards concerning these aspects. Therefore, we assume:

H2.2: The quality barriers are highest in guidebooks, second highest in wikis and lowest in forums.

While printed travelbooks may still be more popular than online communities, the incentive to make a contribution is clearly higher for communities. A contribution to a guidebook could be a letter to the editor. The consideration of this letter is uncertain, however, and the reader would have to wait until the next edition is published to see his proposition realized. In a wiki, a contribution is published and recognized by the community immediately. Thus, the social effect of a publication is experienced directly as well as feedback on the content. In forums, the immanent social reward is still bigger since a concrete query can be answered which establishes a closer social relationship between the members of the community. Thus, we assume:

H2.3: Forums have the greatest activity potential, wikis have the second greatest activity potential, and guidebooks are the media with least activity potential.

We accept that quality barriers will significantly influence the quantity of information entering a medium. But quality barriers are only important for information that reaches the barrier. There is comparatively little of it reaching a guidebook, as there is little incentive to enter information and the medium is inflexible. In the comparison of wikis and forums, we believe, the higher incentives to contribute to a forum are key. Thus our summative hypothesis on the revision cycle is:

H2.4: The dominant factors are activity and flexibility. Therefore, the overall revision cycle is shortest in forums and longest in printed guidebooks.

Assumption: Domain volatility

When analyzing and comparing up-to-dateness in different sources, it is important to take the volatility of information into account. Comparing sources using items with widely differing volatility may lead to distorted conclusions. As in Prestipino et al. [07], we used categories for tourism-related information, for example, accommodation information. We purport that volatility of information items of each category will be the same on average, and therefore we argue: *Information has different lifespans, but the volatility of information of any given category is the same in all three media.*

For an aggregation into a new overall hypothesis on up-to-dateness of travelbooks, wikis, and forums, we have to take the domain volatility into account: For stable information, the initial up-to-dateness is most important and thus guidebooks will be better than forums. The more volatile the domain is, the more important is the revision cycle and thus forums will be more up-to-date. Forums have a significant draw-back in their initial-up-to-dateness; guidebooks are hampered by their long revision cycle. Wikis can combine the strengths of both media without their disadvantages. Thus, wikis should be most up-to-date. Thus we propose a revised version of our overall hypothesis from 2005 (as explained in the introductory section of this paper):

H0.1: The overall up-to-dateness is best in wikis. For volatile information, forums are second; for

stable information, guidebooks are second.

As we know from section two, our current data does not support the overall advantages of any medium. Regarding wikis this may be explained by the fact that they are a new, still emerging travel medium. For forums, their structural qualities may be an explanation. The following section will look at those structural qualities in a more detailed analysis.

A second look at the empirical data

We now present detailed data on the up-to-dateness of the individual media. Figure 3 shows the proportion of up-to-date information on accommodation prices. On a descriptive level, we see that the two guidebooks, Lonely Planet and Moon Handbook, are pretty close to each other, 22% and 24%, respectively; the forum communities, Thorn Tree and Virtual Tourist, vary decisively and significantly, 47% and 16%, respectively; and that the wikis, Wikitravel and World66, are quite homogeneous, 27% and 24%, respectively.
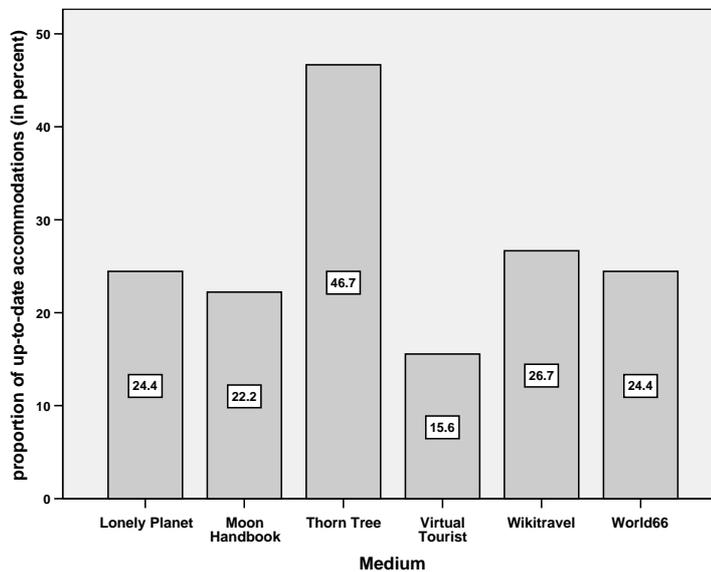

Figure 3: Proportion of up-to-date accommodations

The differences between the forums can be explained with the much faster revision cycle of information. While Thorn Tree had about 700 discussion threads per month during the observation period, virtual tourist had only about 150 discussion threads. We thus hypothesize that while the flexibility and the quality barriers are equal for both forums, the activity potential leads to a higher up-to-dateness of the Thorn Tree forum. The impact is so strong that it more than balances the initial up-to-dateness of the other media. The Thorn Tree is significantly more up-to-date than the average of the two wikis and the two travelbooks (log. regression: omnibus chi-square = 1.46, df = 1, p < .05). While the lower values for the Virtual Tourist forum do not reach significance (log. regression: p = .18) the data indicate that with a lower activity level (and thus a longer revision cycle), the lower initial-up-to-dateness can dominate the overall up-to-dateness.

5   CONCLUSIONS

Prestipino [04] and Prestipino [06] discussed technical differences and shortcomings of different technologies used by virtual communities. With the factors presented here, we posit that these technical shortcomings have clear implications for up-to-dateness. The time for externalization in a forum is dependent on someone asking questions, as there is no structure to put information into.

Abandoned threads may still contain valuable, up to date information, but be mixed up with outdated information. They do not receive attention anymore by the community; thus, they are no longer the externalization of the community knowledge. As the typical way of searching a discussion archive is using a full-text search, very old information may be presented to the user. Wikis, on the other hand, require a high level of activity to keep information up-to date, as all information entered is preserved. This may explain the poor results for World66 in our empirical assessment, as it seems the wiki was initially filled with information acquired externally and then given to the community, resulting in the community being too small and not active enough to keep this amount of information up-to date. Wikis offer shared material but almost no communication support. It is difficult, if not impossible, to ask questions regarding new or individual information needs. Therefore, using just a wiki without discussion space does not take advantage of the community's capability to offer a powerful social interface to its currently available knowledge.

Lonely Planet's Thorn Tree forum keeps only a small archive of discussions, deleting most threads two months after they have been abandoned. While this does not solve structural problems of forums, and also means valuable information could be deleted, it certainly helps to reduce the number of different revisions and the age of the information in the medium. More specifically, the possible delay between the point in time when information is entered into the system and the moment when it is retrieved by a user is reduced (cf. discussion of publication speed above).

So what is the most promising approach for a user looking for information in virtual communities? Based on our research, we conclude that it is best using wiki communities. Of course, the community should be highly active in terms of number of users and posts per day. A user should always try to observe information about when information was stored in the system and whether the authors reveal how old the provided information is. A user may view the changes recently made in the whole system to assess the activity level of the community. A check of some random pages will give a general impression about whether quality standards (e.g. good writing, coherent texts, good structure) are valued in the specific community. If no wiki is found, the next best strategy is to use a guide book for stable information and a forum for volatile information.

What do the different construction principles and observed user behaviour mean for the future of travel information? The following trends have to be taken into account:

1. The increasing popularity of communities will lead to shorter revision cycles both in forums and wikis, and thus lead to more up-to-date information in both media.

2. Internet-Cafes and the diffusion of mobile Internet-access and mobile devices increase the possibilities of authors to write while travelling. Both forums and wikis benefit from the faster externalization of knowledge and better quality of observation when travellers enter information while on site.

3. There is increasing up-to-dateness of information services on the web as information from institutional or other original information providers is directly linked in communities, instead of authors creating a copy of information that needs to be kept up-to-date.

These three trends will shorten the time frame, in which a guidebook is more up-to-date than community-based systems. If the time frame is too short, the current business model does not work any more and travellers will not rely any more on guidebooks for volatile information. Travelbook publishers will then have to concentrate on stable information and value added by other editorial work such as structuring information. There is, however, an increasing interest in commercial companies to leverage the potential of tourism communities. Even more than in Wikipedia, there is a high commercial interest in the "truth" distributed by the media. Systematic manipulations (ranging from crude spamming of forums to sophisticated opinion-design by spin-doctors) may hinder or even prevent community based information systems from realizing their potential.

Further research is required to understand the role of speed of externalization in a wiki or forum community for initial up-to-dateness. How old is information on average when entered into the

system? Likewise, as for the revision cycle, a better understanding of the activity potential is needed: a large community has a lot of readers, of whom only a fraction also writes.

From a systems design perspective, our findings confirm earlier propositions [Prestipino 04], [Prestipino 06] that wikis and forums by themselves are not the definitive tools providing high quality. A combination of both technologies looks promising, and in the ideal case, there would be an integration of other community information systems (e.g., recommender systems) and personal spaces (Blogs). For discussion based communities, it is important to take into account that because of poor quality of observation and longer time for externalization, revision of information in a forum does not necessarily mean that old information is corrected or that more up-to-date information is introduced. Because of poor structure and an orientation towards discussion support, forums actually have several revisions of information visible at a time. While the aging and obsolescence in forums foster a shorter revision cycle, older threads, with a higher probability of containing outdated information, are still accessible. Also, the existence of old information in a forum or wiki does not imply that it is still up to date, as it may just not have been observed by anyone capable or willing to correct it. Because information production is not managed, a user has a certain degree of uncertainty about up-to-dateness of information presented to him in a wiki or forum. Because of the heterogeneity of up-to-dateness of information published even in recent discussions, it is difficult for a user to assess up-to-dateness. A system should provide data about how often an information has been viewed, and when it was retrieved the last time, to assess how up-to-date it might be. Providing users with data about the level of activity in a community could help them assess quality of information.

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