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Abstract

Social media enables new ways of communication as well as of information and knowledge sharing. As a subgroup of social media, microblogging is more and more used in companies and organizations to improve communication with their stakeholders. To gain insights on how to use microblogging successfully, this research surveys how Austrian universities use the most popular microblogging service Twitter. Therefore we research the cases of seven active Twitter accounts operated by Austrian universities and examine all 1,750 messages released by those accounts. We also survey Twitter accounts that follow the identified university accounts as well as all other Twitter accounts followed by them too. Thus we create two network graphs covering 1,256 respectively 25,887 Twitter accounts. Our results indicate that Austrian universities are mostly using Twitter not adjusted to the new features offered by this technology. Results also suggest that Austrian journalists are using Twitter in a more effective way than other users. Due to our results we draw out success factors based on a techno-social focused weblog success model covering the three success dimensions content, technology and social value.

Keywords: twitter, microblogging, success factors, case study research, social network analysis.

1 INTRODUCTION

Social media includes a wide range of different applications with diverse characteristics. One subgroup of social media is microblogging and services like Twitter or Yammer. In the context of microblogging, the service Twitter has significantly shaped its concept and is one of the most important and well-known services in the field of social media (Barnes and Böhringer 2009; Riemer and Richter 2010). The main-functionality of Twitter is to enable users to write and search for short (limited to 140 characters) text-messages also called tweets as well as to subscribe to messages of other users. According to a statistic released by Twitter, Twitter users have published 50 million tweets per day in January 2010 (Weil 2010). With 28 million unique visitors in May 2010, Twitter.com is one of the most popular social media services (compete.com 2010). Research categorized Twitter usage (Java et al. 2007) and identified four intentions for people to use Twitter:

(1) Daily chatter who are writing about their daily routine or what they are currently doing.
(2) Users who are having conversations using the @-character or
(3) sharing information and URLs or
(4) reporting latest news respectively commenting current events.

As those results indicate, Twitter can be utilized in several different ways. Using URLs in their tweets, users can share different types of content like pictures, videos or more in detail reports. The usage of special characters enables Twitter users to categorize tweets e.g. by using hash tags respectively the #-character in front of a word, that indicates that the tweet belongs to a certain topic. Furthermore tweets can be assigned to one or more twitter users by adding the @-character in front of a username.

Due to its functionality, microblogging can be seen as intermediate between instant messaging and weblogging (Passant Hastrup, T., Bojars, U., Breslin, J. 2008). It features a fast way of communication that can be used to broadcast messages and reaches a wide range of users. By searching for hash tags, users can read tweets on a certain topic. Because of its short text-messages, Twitter is also widely used on mobile devices. For those reasons, microblogging is often described as a new kind of communication channel (Zhao and Rosson 2009). Due to those characteristics Twitter enables users to write messages very fast (as tweets are limited to 140 characters) and on the go. In the case of news-reporting this enables users to give nearly real-time news updates on happenings to a wide audience (Hermida 2010). Examples are the news coverage of a crash-landing of an airplane in the Hudson River (Hermida 2010; Lenhart Fox, S. 2009; Patalong 2009) or from other emergency events like the southern California wildfires (Hughes and Palen 2009; Sutton et al. 2008). Using special add-ons like TweetPic[1] users can even broadcast photos of a happening. The picture will be uploaded to TweetPic and a shortened URL of the photo will be added to the tweet.

Acknowledging microblogging as new kind of communication channel respectively as a new kind of technology, the question arises how this technology can be successfully applied to support certain tasks. As mentioned before, Twitter had been successfully applied to enhance news-coverage on happenings. Thus we propose that this technology can also be used to improve organizational processes like room scheduling or enhance information sharing. To assess this question we survey the case of Twitter usage of Austrian universities. To gain insights on the usage of Twitter by Austrian universities, we propose the following five sub research questions:

- RQ1: Which Austrian universities are using Twitter respectively run a Twitter account?
- RQ2: What kind of messages do they publish?
- RQ3: Which users are following those messages published by university accounts?
- RQ4: Which other accounts do the followers of university accounts follow too?
- RQ5: Which Twitter users are most influential on the users following an university account?

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[1] http://tweetpic.dev.agriya.com/

The remainder of this article is structured as follows. First we will review related literature and draw out the theoretical foundation. Then we will describe our method and present the results of our observations. Last, we will conclude and discuss our results with both theoretical and practical implications. Limitations of our study and possible future research topics will also be discussed.

2 THEORETICAL FRAMEWORK

2.1 Theoretical Fundament

To identify relevant literature that contributes to our proposed research questions we performed a literature review using scientific databases (EBSCO Computer Source and Business Source Premiere, ACM Portal, Gartner Advisory Intraweb, Science Direct, Google Scholar SFX and Mendeley Literature Search) and the following search query: (Twitter OR Social Media OR Microblogging OR Weblog) AND Success.

Our literature review shows that research focuses on various topics in this field but not in particular on the implications for universities. Surveys which examined Twitter usage (Huberman et al. 2009; Krishnamurthy et al. 2008; Kwak et al. 2010) do not focus on the question of how academic institutes are using Twitter respectively microblogging. Opening our view to general research on microblogging usage, studies concerning the flow of information and language used in microblogging (Boyd et al. 2010; Honeycutt and Herring 2009; Lerman and Ghosh 2010; Zhao and Rosson 2009) indicate advantages of microblogging usage in collaboration, mobilization of people and communication. These results contribute to some extent to our research question as they identify areas where microblogging could be used to improve tasks. Different studies on social media in general have surveyed best-practice cases and developed systematic ways of understanding and conceptualizing social media usage for companies (Hanna et al. 2011), researched Facebook usage of nonprofit organizations (Waters et al. 2009), developed frameworks to describe social media services to derive social media strategies (Kietzmann et al. 2011) or extended traditional processes for media spending to guide spending decisions for social media. Overall, these studies target topics related to social media strategy, operational success factors for Twitter are not targeted. Another study by (Freberg et al. 2011) surveyed the core perceived attributes of so-called social media influencers (users of social media services who are very influential to other social media users) by applying a q-sort technique. (Fischer and Reuber 2010) surveyed how effectuation processes are impacted when entrepreneurs adopt Twitter. They propose two factors that moderate the consequences of social interaction through Twitter: community orientation and community norm adherence. Community orientation reflects the extent to which entrepreneurs are inclined to use social media to embed themselves in such networks while community norm adherence describes the extent to which entrepreneurs' tweets conform to or deviate from norms among those who use Twitter for business purposes. These studies target the attributes of the Twitter users. Acknowledging microblogging as a technology that can be seen as a kind of information system, IS and user acceptance research offers several well established models that predict the success of new technologies. Considerable success models are the IS success model (Delone and McLean 1992; DeLone and McLean 2004; Delone and McLean 2003), the technology acceptance model (Davis 1985) or the task technology fit model (Goodhue and Thompson 1995; Goodhue 1998; Goodhue 2000). In extend to those more general models, IS science also developed a success model for weblog success (DU and WAGNER 2006). Unlike traditional success models, this model allows a more techno-social and value-driven explanation that better fits social computing technologies like weblogs and microblogging. The model covers three success dimensions that influence the success (in terms of popularity) of a weblog: content, technology and social value.

- type and quality of information
- frequency and volume
- presentation and organization

Content value

- manage content (hash tag)
- online sociability (@)

Technology value

- followers

Social value
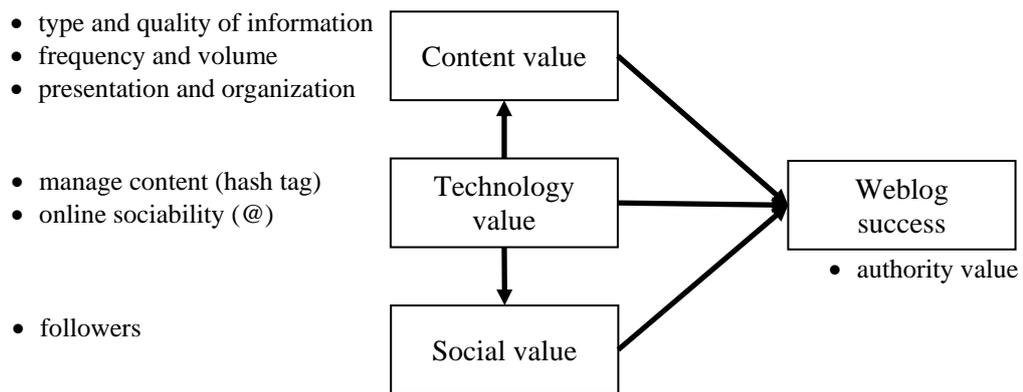
Weblog success

- authority value

Figure 1.   Extended weblog success model cf. (DU and WAGNER 2006).

Content value includes measures like quality and type of information provided, frequency and volume of new postings, presentation and organization of content. This is also applicable on the case of Twitter. Technology value covers the ability to create and manage content and to facilitate online sociability. Both abilities can be achieved on Twitter by using a hash tag (#-character) and @-characters when publishing messages respectively tweets. The third dimension social value is also applicable to Twitter and can be measured by the count of followers of a user. The more followers a user has, the higher is the social value of the account. (DU and WAGNER 2006) used popularity as measured by the Technorati ranking to define the success of a weblog. Technorati ranks weblogs due to the number of inbound links they receive. To define success of Twitter accounts we use a comparable approach by calculating the authority value of certain accounts using the HITS (Hyperlink-Induced Topic Search) algorithm (which is comparable to page rank). The authority value states out how influential one node is to other nodes in a certain network. Figure 1 shows the weblog success model extended by Twitter related measures.

Microblogging shares many similarities with weblogging as the main-functionality of both services remains to read respectively write text containing messages and weblinks. Due to the similarities between microblogging and weblogging we assume that the proposed model is applicable to explain success on Twitter. Thus we will use the described dimensions to explain our observations on the Twitter usage of Austrian universities.

On an abstract view, Twitter can be seen as a social network. There are several ways for users to establish connections to others. One obvious way is by following messages of other. Seen as a network graph, accounts are nodes and if they follow the messages of another account, this is an outgoing respectively incoming connection between those two users. We call the sum of incoming connections indegree and the sum of outgoing connections outdegree. Other ways of establishing connections could be by sending direct messages (e.g. by typing the @-character in front of the username of the recipient of the tweet) or writing tweets on a certain topic (e.g. by using hash tags). In this research we will limit our view to connections established by following messages of other users.

2.2   Research Design

The starting point of the survey is research question one. To identify active Twitter accounts that are operated by an Austrian university, we use the Twitter search function to search for usernames that match the nomenclature of Austrian universities. Therefore we develop a search strategy based on the official nomenclature of all Austrian universities. To be sure that we only identify active accounts, we declare that active accounts have to have at least published five messages and hold ten followers. Using the identified university accounts, we analyze the messages published by those accounts to cover research question two.

To examine research question three, we identify all Twitter users who are following messages of at least one of the university accounts and collect their profile information as well as their outgoing and incoming connections. Based on their connections, we conduct a directed network graph to analyzed and cluster those users. A directed network graph means, that connections respectively edges have a direction e.g. following a user is an outgoing connections. In the following, we will call this network graph the first layer network graph.

Dealing with research question four, we extend the first layer network graph by adding all accounts that are followed by the followers of university accounts. This network graph will be called the second layer network graph. In respect to research question five, we apply the HITS algorithm to rank users by their influence on the considered network.

3 METHODOLOGY AND DATA COLLECTION

3.1 Sampling

Applying our search strategy we identified nine university accounts. After reviewing the messages published by those accounts, two accounts have been excluded. This was due to the fact that the messages published by those two accounts were in no context to the universities the accounts should represent. Table 1 shows the identified Twitter accounts, their count of tweets, followers, following and days online. The excluded accounts are marked with [x]. The data was collected on the 9th of November 2009. Using the seven selected university accounts, 1,256 followers have been identified and examined. As 184 users of the considered network are following more than one university account, the network graph shows 243 overlaps. The so conducted first layer network graph includes 1,495 edges. For the conduction of the second layer network graph, we define a restriction due to the fact that some users follow up to 76,223 other users. For the subsequent analysis, we establish the following assumption (A1): Ordinary users, who are not automatically processing their Twitter feed (a live stream of all messages they receive) can`t handle to follow more than 500 other users. Grounded on this assumption, we only include users who are following less than 500 other users. The conducted second layer network graph includes 25,887 Twitter accounts respectively nodes and 46,073 connections respectively edges.

Universities	Usernames	Tweets	Online since [days]	Frequency [tweets/day]	Followers	Following
University of Vienna	uni_wien [x]	9	246	0.037	523	171
	ubwien	56	173	0.324	172	0
	sowi_wien	38	395	0.096	111	15
University of Graz	UniGraz	62	185	0.335	193	21
University of Innsbruck	UniInnsbruck	232	255	0.910	665	504
Graz University of Technology	Sociallearnig [x]	122	466	0.262	546	10
	tugraz_news	1,182	197	6	176	0
University of Klagenfurt	dieTEWI	57	236	0.242	60	1
Innsbruck Medical University	imed_tweets	123	238	0.517	122	2

Table 1.   Specific values of identified Twitter accounts operated by Austrian universities.

To collect the data a self-developed Java desktop application was used. The application uses the Twitter API (application programming interface) and saves the collected data into a MySQL database. To analyze the data, messages and profiles have been exported to the CSV-files (Comma Separated Value) and the network graphs to pajek-netfile data format.

3.2   Analysis

We use methods from the fields of social network analysis, text mining and descriptive statistics. For automatic analysis of text content, noise words have been removed from the text and the remaining words have been counted by their frequency (Feinerer 2008). This method was used to analyze the messages of universities as well as to analyze biography and location data of followers of university accounts. To strengthen the results we also analyzed the last 80 messages of each university account manually and clustered the messages into six types. This method has been used to address research questions two and three. In extend to research question four and to analyze the social network, we added the number of followers and following of each user to the representing nodes in the graph and clustered them as follows: section A (Followers <= 100; Following > 500); section B (Followers > 100; Following > 500); section C (Followers > 100; Following <= 500); section D (Followers <= 100; Following <= 500). Using these values and classification we calculate the correlation between incoming and outgoing connections and analyze the biography data of the users for each Section.

To examine research question five we calculate indegree and outdegree values for the nodes of the second layer network graph as well as the authority and hub value using the HITS algorithm (Kleinberg M. 1999; NWB Team 2006). The HITS algorithm is comparable to page rank and can be used to assign authority values to nodes in a network indicating their influence on other nodes in the same network. The indegree and outdegree values differ to the number of followers and following of each user as the indegree and outdegree only take the connections within in the considered network graph into account. We use authority values to rank the users by their influence on the considered network. In contrast to a ranking based only on the number of incoming connections, the HITS algorithm weights the incoming connections by the authority value of the sending node (Kleinberg M. 1999; NWB Team 2006). The authority and hub values for the node p belonging to set S are calculated as follows:

$$\text{Authority}(p) = \sum_{v \in S,\ v \to p} \text{Hub}(v) \qquad\qquad \text{Hub}(p) = \sum_{u \in S,\ p \to u} \text{Authority}(u)$$

To perform the analysis we use Network Workbench.

4   RESULTS

By searching for Twitter accounts operated by Austrian universities (research question one), we identify 15 accounts using usernames matching the nomenclature of an Austrian university. After applying our defined restrictions, the number of fitting accounts was reduced to nine. In the reviewing process of the messages published by those accounts, we decided to exclude two more accounts from the following analysis, as the messages published by those accounts were in no context to the university that the accounts should represent. The results concerning research question one are shown in Table 1. According to our results, six out of 16 Austrian universities are operating a Twitter account.

To address research question two, we reviewed messages published by the identified university accounts. Performing this review, we could identify six topics by which we classified the messages. The six topics are: (1) University news in general; (2) Announcements of university happening; (3) Organizational announcements concerning e.g. the class and room schedule; (4) News about the research activities of the universities; (5) Offerings for second-hand goods; (6) Miscellaneous messages which are not in context with the university and its members. Results of the classification are shown in Table 2. Messages about schedule changes are only regularly used by the university library and faculty of social sciences at the University of Vienna. In this context it should be annotated, that at the time of the data collection, Austria wide student strikes took place.

Twitter username	(1)	(2)	(3)	(4)	(5)	(6)
ubwien	37 %	13 %	43 %	0 %	0 %	7 %
sowi_wien	10 %	24 %	61 %	0 %	0 %	5 %
UniGraz	39 %	35 %	2 %	23 %	0 %	1 %
UniInnsbruck	36 %	29 %	0 %	33 %	0 %	2 %
tugraz_news	14 %	34 %	0 %	14 %	36 %	2 %
dieTEWI	50 %	21 %	7 %	16 %	0 %	6 %
Imed_tweets	44 %	9 %	0 %	45 %	0 %	2 %

Table 2.   Classification of the messages published by university accounts.

The following results are address research question three. The survey of the location data of followers of university accounts shows that most of followers are from German speaking countries (68 % Austria; 25% Germany). An in depth review of the location data of the followers of the University of Graz indicates also, that most followers are from the surrounding regions (50 % are from Styria). The word frequency analysis on the biography data shows that the term "student" is the most frequent word used in the biography data of the followers. By performing a manual aggregation of words into classes with corresponding topics, we identified that names of locations are most common, followed by the term "student" and words corresponding to news reports and journalists. Results are shown in Table 3.

Rank	Topic	Frequency
1	Austria and locations in Austria	143
2	Student	74
3	News, Information, Tips, Trends, Journalist	68
4	University	53
5	Marketing, Management, Business	37
6	Life and Lifestyle	36

Table 3.   Common topics used in the biography data of the followers of university accounts.

Figure 2 shows the number of followers and following of users who are following university accounts visualized as a scatter plot. The Kendall tau rank correlation between incoming and outgoing connections is 0.73 and Spearman`s rank correlation coefficient is 0.89. The median of indegree values is 83 respectively 136 of outdegree.
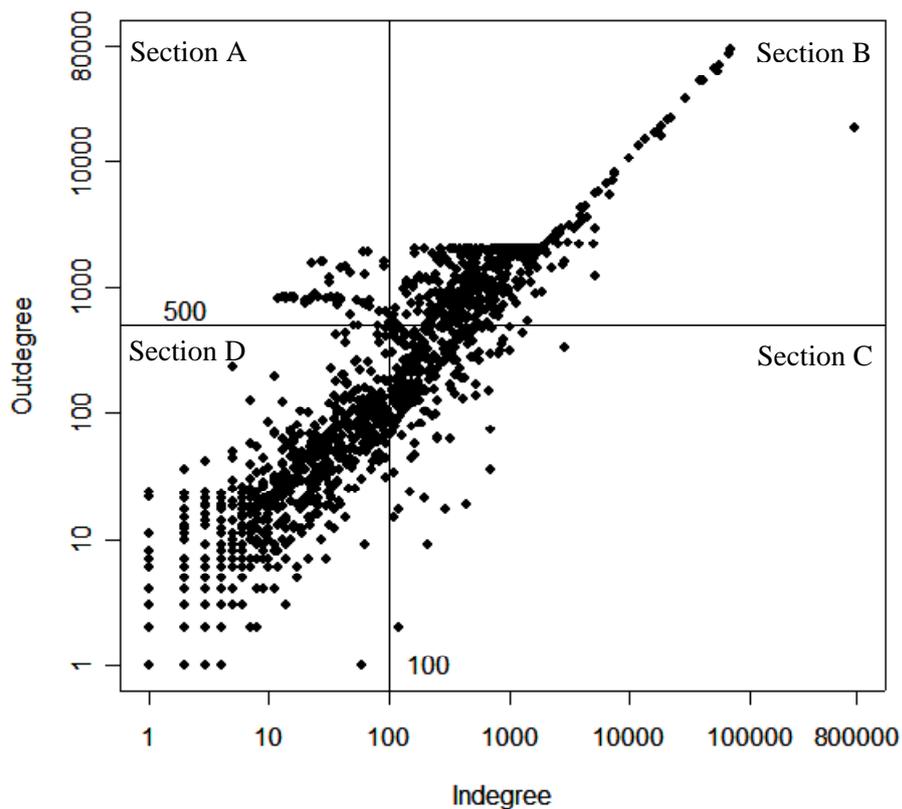
Figure 2.   *Number of followers (indegree) and following (outdegree) of each follower of an Austrian university account.*

A profile data analysis of the users in Section A was not possible due to the fact that none of those users provides any profile information. The analysis of the other three Sections shows, that users in section B use words like (1) "www", (2) "online", (3) "Twitter", (4) "marketing", (5) "http" or (6) "news" in their biography. In contrast to that, users in sections C and D commonly use words like "student" (first in C and D), "university" (fourth in C; second in D) or "Austria" (second in C; fourth in D) in their biography.

A review of all accounts that follow more than two university account shows, that usernames of all those accounts are related to names of companies or organizations. One example is the account "sunnycruise" that is related to the cruising company Sunny Cruise and follows five out of seven surveyed university accounts. Figure 3 shows a visualization of the network graph. To address research questions four and five, we rank the users by authority value and incoming connections. The rankings differ, as mostly Austrian journalists are ranked in the top ten by authority value in contrast to the ranking by incoming connections where mostly famous politicians, newspapers and TV-stations are ranked in the top ten (see table 4).
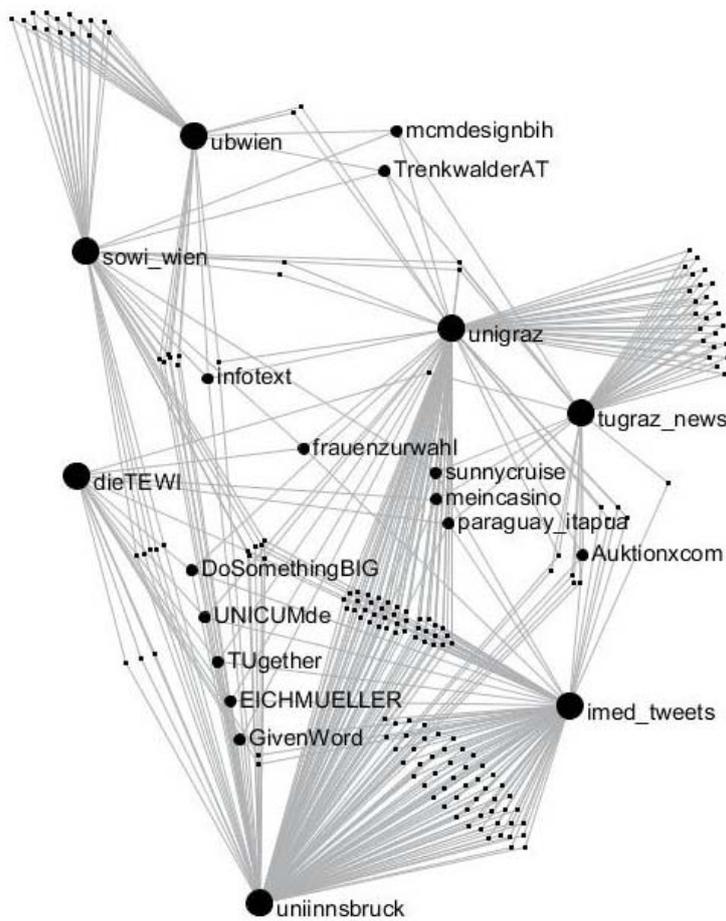
Figure 3.   *Network graph of accounts that follow more than two university accounts.*

HITS Rank	Δ	Name	Category	Follower
1	1	Armin Wolf	Journalist	9,593
2	-1	Uni Innsbruck	University	665
3	5	Martin Blumenau	Journalist	2,207
4	8	Robert Misik	Journalist	3,149
5	6	Ingrid Thurnher	Journalist	1,611
6	-1	Barack Obama	Politik	2,706,531
7	7	Corinna Milborn	Journalist	1,507
8	2	Unibrennt	Students' remonstrations	2,373
9	-6	UB Wien	University	172
10	11	Dieter Bornemann	Journalist	1,479
11	17	Christoph Chorherr	Politician	1,289
12	-3	Gov. Schwarzenegger	Politician	1,423,856

Table 4.   *Influence rank based on indegree compared to influence rank based on authority value.*

5   DISCUSSION

Results show that Austrian universities sparsely take advantage of Twitter`s special potential of instantly reaching a great number of receivers, with short delay concerning topical events, but rather use the service as another channel to mirror their regular news output. In comparison to the number of students of each university, the number of followers on Twitter is minor. We conclude that none of the researched accounts uses Twitter in a successful way.

We assume that this is due to the fact that university accounts on Twitter only provide the same information as on the official university websites. In reference to the proposed success model, this would indicate weakness in order of the success dimension content. As a result of this university accounts also don't use hash tags or @-characters resulting in a weak technology value as they do not use all features offered by Twitter. We assume that this behavior results in low social value (only few followers).

In contrast to that, results show indications that authority value of users who are using Twitter in a more dialogue based way are higher as for those users who are sending their regular news through Twitter. This conclusion is based on the notice that Twitter accounts of newspapers and TV-stations (which are mostly only mirroring their ordinary news output to Twitter) are ranked in the top ten by indegree but not by authority and that Twitter accounts of Austrian journalists (who are mostly working for those newspapers and TV-stations and writing tweets in a more dialogue based style) are rising and overtaking those accounts in the ranking based on the authority value. Hence we assume that the usage of the @ and # characters respectively a more dialogue based communication style that uses the full technological capabilities of Twitter is linked to success of Twitter users in matters of influence and popularity.

We see this as a first step towards a success model for Twitter. Our results are first indications but do not fully prove our assumptions. Future research should target empirical evidence to prove the proposed model. As the proposed success model is limited to IT related factors, we suggest that research should also target none IT related factors like brand name, celebrity effects or motivation of usage. Even the proposed model is not fully proven and can only be seen as a first step towards a success model, based on our results we suggest practitioners to consider the proposed success dimensions to guide decisions in context of microblogging. Thus our study contributes to the literature by proposing a model of success factors for microblogging and presenting empirical data on the Twitter usage of Austrian universities.

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