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'TweetBoard' – a case study of developing a micro-blogging platform for higher education

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Abstract: This paper reports experiences made at an Asian university in developing a social media platform based on Twitter in the context of a final year capstone project where information systems management students get an opportunity to solve ‘a real-world problem for a real client’. In this case study, the challenge was provided by a faculty member’s request for an interactive social media application which engages less outspoken students in class via a social medium they are familiar with: Twitter. We reconstruct the project’s evolution; describe the main features of the application called ‘TweetBoard’ and share lessons learned in developing a new pedagogical micro-blogging tool in support of students’ learning.

Keywords: Twitter; micro-blogging; higher education; blended learning; pedagogy; Singapore.

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1 Introduction

'TweetBoard' is a new web-based application developed by a team of (final year) information systems management students under the sponsorship and supervision of faculty members from the university's school of information systems (SIS) and business school respectively. The primary goal of the application is to create a vibrant and highly interactive learning environment for students and instructors, through the use of Twitter.

Twitter (a website, owned and operated by Twitter Inc.) is a social networking and microblogging service enabling users to send and read messages called *tweets*. Tweets are text-based posts of up to 140 characters displayed on the user's profile page. The 140-character limit is a result of the service's founding process because it was intended originally to be used mainly over mobile texting. The advantage is that it requires users to get right to the point.

Using real-time displays of students' tweets in class, TweetBoard encourages students to actively participate in class through the sharing of additional information, re-tweeting content provided by other students or 'promoting' certain tweets to key class discussion points. In addition, TweetBoard provides instructors with an analysis of class trends so that they can recognise issues students might be facing, for example, through a sentiment analysis of students' tweets (Bifet and Frank, 2010). Instructors can then adjust their style of teaching accordingly.

The TweetBoard project was triggered by the concerns of a business school instructor about the need to engage the less outspoken students in the classroom with the help of micro-blogging approaches in order to stimulate interesting in-class conversations and debates (Menkhoff and Bengsston, 2012; Naaman et al., 2011; Dunlap and Lowenthal, 2009). The inspiration itself can be traced back to a twitter study conducted by Professor Rey Junco (Associate Professor and Director of Disability Services in the Department of Academic Development and Counseling at Lock Haven University) aimed at examining its engagement power in the classroom. In his research published in 2010 by the *Journal of Computer Assisted Learning*, Junco and colleagues concluded that it "provides the first piece of controlled experimental evidence that using Twitter in educationally relevant ways can increase student engagement and improve grades, and thus, that social media can be used as an educational tool to help students reach desired college outcomes" (Junco et al., 2010).

While Junco used Twitter quite extensively in the context of course-related communication and collaboration activities such as book discussions or service learning projects, we tried to harness the power of tweeting initially for rather straightforward class activities such as commentaries and discussions of in-class project presentations (Java et al., 2007; Leaver, 2012). Help was provided by colleagues in the university's information systems school (SIS). The structure of SIS' final year project (IS480) requires students to identify 'real' clients in order to gain experiences with the design and development of IT-related projects. In our case, key 'clients' included:

- 1 a business school professor requiring a social media platform to conduct participatory class activities as well as the provision of relevant analytics for a better understanding of tweeted content generated by students in class
- 2 students contributing to class discussions through hashtags.

The motivation behind the TweetBoard project encompasses pushing the boundaries of integrating social media into the educational space (Lee, 2015; Blanch et al., 2014). The key performance expectation was to create a programmed platform to enable instructors to leverage the simplicity of tweeting to stimulate in-class discussions about course-related topics. A majority of students in higher education have mobile/electronic devices that can easily connect to Twitter which represents the fundamental basis of this project. The following questions guided the development of the social media platform:

- How can social media technologies like Twitter enrich the learning experience of students in institutions of higher learning?
- What are some of the challenges of implementing tweeting initiatives in the classroom?
- To what extent does micro-blogging enhance both active class participation and students' overall performance?

Previous pilot projects conducted by the author(s) have shown that Gen Y students are quick to leverage on the Twitter platform (Menkhoff et al., 2015, 2011). In initial class experiments with Twitter, Tweets were used to cheer presenting student groups on which turned out to be good for the overall motivational climate in the classroom. Tweeting also allowed absent students to participate in class discussions and commentary flows. Students used Twitter to raise new issues and content-related questions not considered by the instructor during class preparation which were then addressed in class. Through active micro-blogging, students contributed valuable content to a course and enriched the learning process (Ebner et al., 2010). As one micro-blogger pointed out during a post-class feedback session:

“I think in-class tweeting is good because it allows us to voice out our opinions on certain subjects in class. Especially when time is short during our lecture, twitter provides another platform for discussions to happen. Also, twitter provides some sort of ‘casual discussion’ that would put students at ease, especially for some students that are not comfortable with voicing out in class. ... Twitter should be a platform where students post comments that facilitate a good and meaningful discussion.” (A student in a knowledge management class, academic year 2010/2011)

Some students stressed that they were confronted with ‘cognitive overload’ and ‘too many tweets’ which prompted the search for a programmed solution: TweetBoard.

2 Design considerations: customer needs and platform functionalities

We identified three competitors of TweetBoard, namely TweetWallPro, PigeonHole live and TweetDeck, and compared their features with our newly proposed platform. TweetDeck, a platform owned by Twitter, allows users to view analyse multiple topics at a glance. TweetWallPro and PigeonHole live are event-based platforms (however, they do arguably not pay sufficient attention to tweet storage after every event). PigeonHole live requires users to download the application before usage.

We categorised our TweetBoard platform functionalities into:

- 1 essential
- 2 advanced
- 3 additional capabilities.

Essential capabilities are basic functionalities that every platform should have to help encourage discussion without speaking out in class. Advanced capabilities go beyond basic functionalities to analyse the tweet content and understand the discussion patterns better. In contrast to existing applications offered by other platforms, our TweetBoard platform provides additional capabilities. These features were added based on client requirements and our own research on what might enhance students' learning.

Our essential capabilities provide live tweets feed on a dashboard for student to participate in class discussion, a tweet moderation feature, polling and class facilitator functions. The live tweets will display the popular tweets that have been retweeted or marked as favourites. Class facilitators are able to create, read, update and delete (CRUD) the course, term, session, school as well as class. These essential capabilities allow students to participate in class discussion using Twitter.

In addition, we added advance capabilities to provide some basic analytics, allow customisation of the hashtags, word cloud and aggregation of the tweets. Word clouds display the most used words in a lesson. Class instructors are able to customise the hashtags, date and time of a particular class. They can delete the class as well. Students are identified and notified using their school emails. When analysing the tweets, instructors can filter according to class or students' tweets or polls in real time. Some patterns such as social relationship mappings, class specific patterns, inter-class patterns, sentiment analysis and match words with actual sentiments can be extracted as well. These advance capabilities helps the instructor to understand the pattern of discussions.

Finally, there are additional capabilities to view the photos in the tweets, a DBpedia to extract structured content from the tweets and a list of top student contributors. Of course access to the tweet storage is provided as well. This allows a complete search of the database based on texts, contributors or related content. Top contributors rank the students by the number of tweets they contributed. Admin logs are used to track facilitator and instructor changes to the data storage.

2.1 Social media trends

Our target customer segment in the (higher) education sector are students in the 18–29 age group who drive the rapid growth of the top social networks Twitter, Google and Facebook (Davenport et al., 2014). According to data compiled by self-service platform provider ShortStack, 72% of all internet users are now active on social media. An even larger percentage, 89% are active on social media, if we consider 18–29 age group. Marketers are quick to tap on social media for their business. 93% of them uses the social media.

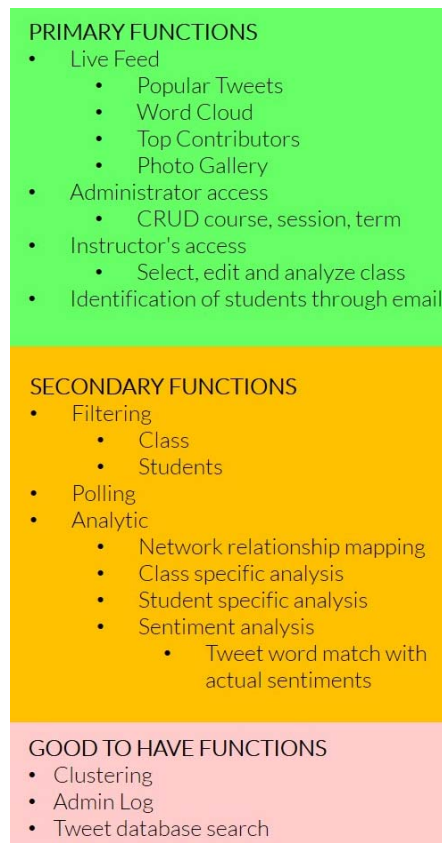
While Google+ have a large brand presence on social media, 70%, up 4% from Q4 of 2012, Twitter is the fastest growing social network. Up 44% between June 2012 and March 2013. Google grew 33% during the same period and Facebook at 23%. By numbers, Facebook has the most at over 1.1 billion users, followed by Twitter at over 550 million accounts, Google+ over 500 million users, LinkedIn at 225 million users

and Pinterest with over 70 million users (<http://www.socialystacked.com/2014/01/the-growth-of-social-media-in-2014-40-surprising-stats-infographic/>).

2.2 Technical functionalities

The technical functionalities of our TweetBoard platform can be summarised by Figure 1.

Figure 1 Tweetboard technical functionality (see online version for colours)



2.3 Application programming interface: search API versus streaming API

In order to pull tweets from Twitter, we considered and compared two services: the search API and the streaming API. At the beginning, we pulled tweets using the former as it was a direct and straightforward method. In order to do this, instructors need to specify a particular hashtag (#) that uniquely identifies their class (usually the module code) and pull the tweets using their account. This method is highly scalable as each instructor's activity is independent of each other. Instructors can change the unique identifier whenever they want. The only problem with using the Search API is that there is a limit to how much one can pull from Twitter (this is to prevent clogging Twitter's servers in case too many requests need to be handled). Another issue is that only tweets

from the past seven days can be retrieved. Any earlier tweet is unreachable. Initially, these problems proved to be a huge obstacle as it takes roughly 20 seconds from the time a student tweets to the time the tweet appears on the screen. In a short lecture, such a time lag may cause the application to be perceived as a disruption rather than as a novel, value added teaching and learning enhancing application.

We then turned to the streaming API. Employing the streaming API is slightly trickier as we had to establish a persistent connection to the Twitter database. We had to pre-define the query words that we wanted to use in advance as well. Users who connect to the Twitter streaming API in quick succession will be banned as they are taking up valuable bandwidth from the Twitter server. This made testing of the application extremely time consuming and problematic. However, the streaming API enabled the instantaneous retrieval of tweets, which was a critical requirement for the application to work in the class setting.

With the collected tweets, we segregated the tweets and classified them based on the class list (pre-loaded by the administrator) and the unique hashtag that was used. With this classification, instructors can now explore the tweets that are contained within a class and analyse them for future use.

2.4 Entity recognition sub-module

The analysis of the tweets is done in real time on the front-end of the application to ensure that the class is able to quickly analyse the tweets, which presumably will help to stimulate more vibrant discussions in class. To do this, tweets undergo some form of filtering before they are converted into visualisations on the dashboard (Heer and Boyd, 2005). An important thing to note is that tweets contain multiple key entities that are required to be filtered out. Firstly, stopwords are removed so that the remaining words to be analysed are relevant to the class content. The remaining content consists of a variety of entities: keywords, hashtags and links.

Hashtags are extracted from each tweet by checking the beginning of each word with the '#' character. This is a convention that has been developed amongst bloggers and twitter users, to explicitly tag a tweet with a topic. These hashtags are added to the leaderboard to show the most discussed words in class. Next, user references are identified and collected. There are two types of user references that can be identified from tweets – *replies to an earlier tweet* or *retweets of earlier tweets*. Tweets which are replies to another tweet contain the username of the referenced user prefixed with the '@' symbol, while retweets contain the prefix 'RT', followed by the original author's username. These character patterns are identified and the referenced usernames are extracted from the tweet and compiled.

Lastly, links are extracted from the tweet by identifying text that matches the text pattern of an internet URL. The compiled data is then sorted by occurrence, with the most common keywords, hashtags, user references and links.

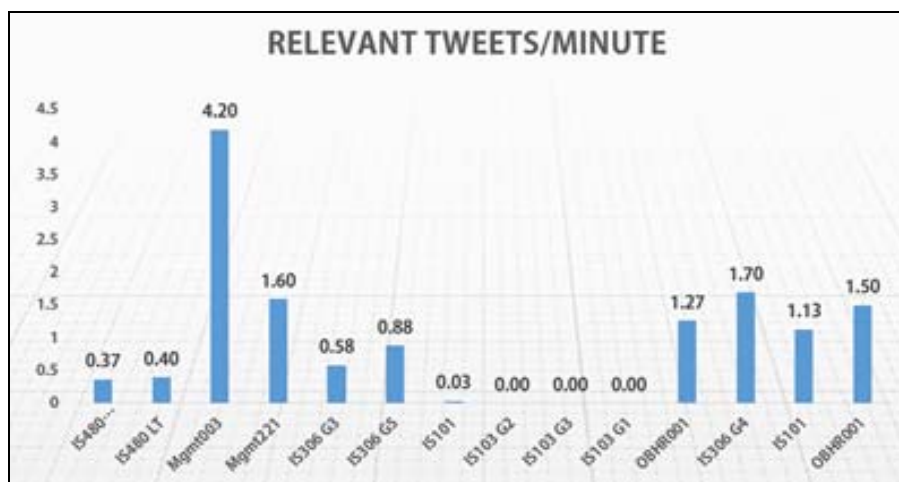
3 User tests: in search of TweetBoard's pedagogical value added

During several user tests, a total of 583 in-class tweets were collected from 13 unique classes, spanning six different modules taught by five different professors which are as follows:

- IS480: final year project
- MGMT003: business, government and society
- IS306: interactive design and prototyping
- IS103: computational thinking
- IS101: foundations to information systems
- OBHR001: leadership and team-building.

To shed light on the potential effect of micro-blogging on enhanced class participation, we tried to quantify the number of tweeted opinions, questions or discussion points that students raised in class. On average, we witnessed an increase of about 400% in terms of class participation during selected course sessions. This seems to suggest more classroom participation.

Figure 2 Calculating relevant tweets per minute (see online version for colours)



However, one of the problems that surfaced was the large number of irrelevant tweets. This happens when students are testing out the system or when they respond to the ‘instantaneous feed’ that appears on screen. To get an accurate picture of the data, we painstakingly filtered out the tweets and only considered the ones that had substantial content related to the respective module. We then calculated the number of relevant tweets per minute as shown in Figure 2. The key was to find out which type of class might be best suited for using an application like TweetBoard. In-class tweeting activities can be categorised as follows:

- the instructor only allows out-of-class-tweeting
- the instructor allows free tweeting throughout an entire (e.g., three hour) class session

- the instructor sets a specific period for the students to tweet.(e.g., at the end of a case analysis in class)
- the instructor sets a specific period for the students to tweet and gives them specific questions to ponder about/assignments.

Of the four scenarios above, the third and fourth approach yielded the most consistent and positive results. Given a specific discussion topic, coupled with questions for students to think about, learners generally voiced out more ideas both via Twitter and face-to-face in class. Disappointing results were obtained in classes which focused on technical content, i.e., in contexts where students need to absorb content rather than generate own ideas as well as in situations where class participation is not actively enforced by the instructor. Some professors were unwilling to use the application when they realised that they had to spend additional time to learn and adopt the system.

3.1 Pilot tweeting test in a leadership and team building class

One of the pilot micro-blogging tests was conducted in an undergraduate class on leadership and team building (LTB) delivered in a blended learning format. Several weeks before that class, students had been given a case template with brief information about governance and leadership issues in a local charity (as a result the chief executive officer and the entire board were forced to step down). Students were briefed about the learning objectives aimed at enabling them:

- to examine the leadership style and conflict management approach of leaders involved in the case based on published case materials and relevant leadership concepts
- to assess to what extent leaders effectively responded to the challenges they and the charity staff were facing during the crisis with appropriate sets of task and relationship behaviours based on followers' behaviour and environmental contexts.

One team prepared a thorough analysis of the case based on the following assignment.

Based on both the video entitled 'leadership with a heart' and the charity case, your challenge is to initiate and lead a dynamic class discussion of about 45 minutes. During your discussion, you must address the following questions, using examples and evidence from the (video) case materials to substantiate your arguments. If you wish, you can go beyond these questions. In addressing the questions, keep the objectives above in mind. You must also relate relevant theories and concepts (in particular: conflict management) featured in our textbook to the case, and get the class engaged in the discussion. Towards the end, do share your own interpretation with the class. Structure your presentation with PowerPoint slides and make sure that all team members are actively involved in the process.

- How would you describe the leadership style and conflict management approach of the leading figures involved in the case (refer to video and case)?
- To what extent did leaders effectively respond to the challenges they and the charity staff were facing during the crisis with appropriate sets of task and relationship behaviours based on followers' behaviour and environmental contexts?

- How did the new interim CEO manage to forge a strong team and to rebuild public trust into the charity?
- What are three key leadership and team-building lessons which can be derived from the case?

During the final presentation of the case analysis by one group of students, the entire class was invited to tweet their comments and thoughts based on a broad question posed by the instructor: ‘what lessons can you personally derive from the case with regard to positive leadership and effective conflict management?’

Typical tweets included statements such as ‘leaders should strive for authentic leadership with strong moral convictions’; ‘I think integrity and basic moral values are important and we should all develop these values’; ‘I learnt that it is important to remain objective and focused rather than getting emotional when faced with a crisis’; ‘a crisis can be managed with determination and sincerity’.

The selected statements suggest that the case analysis by the group in conjunction with the in-class micro-blogging activity helped students to appreciate the importance of ethical, values-based leadership in both business and society as well as the importance of related leadership attributes and skills in line with the pedagogical goal of the LTB course. While the pilot test was rather short to provide comprehensive evidence about the positive impact of tweeting on students’ learning effectiveness in the context of leadership development (Day, 2013), the overall experience was positive and promising.

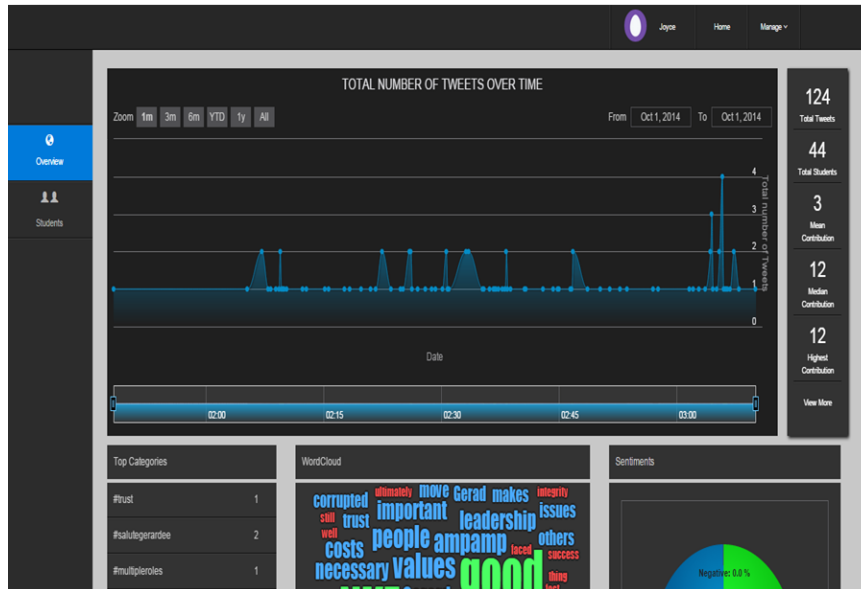
The pilot test confirmed the importance of determining the educational objectives of micro-blogging approaches and to spell them out before the class proceedings begin so that students appreciate both purpose and expected outcomes of using social media tools such as Twitter in teaching and learning (Elavsky et al., 2011). Without the broad question posed by the instructor prior to the tweeting phase (‘what lessons can you personally derive from the case with regard to positive leadership and effective conflict management?’), students’ twittering would have been rather senseless. Thus, it is important to prepare the student if the instructor wants to engage student successfully using a social media tool.

3.2 *Analytics and the way forward*

As requested by ‘the client’, the team provided a built in analytics module as part of the TweetBoard application. A common visual analytics tool is the *word/tag cloud*, where words mentioned are grouped together and their size is displayed based on the number of times they are mentioned as illustrated in Figure 3.

A *time series graph* can help to visualise tweets’ volume trends in particular classes (Heer and Boyd, 2005) as indicated in Figure 3. Identifying key moments where the number of tweets shoots up allows the instructor to revisit certain topics in relation to a popular tweet which can help to stimulate a robust discussion amongst the students. With the help of the ‘top categories’ section, users can visualise relevant non-tweet data via a bar chart, for example, to identify the top five most frequently mentioned topics.

Figure 3 TweetBoard's word cloud function (see online version for colours)



Another feature of the application is the mapping of words mentioned by users with the help of a network diagram as indicated in Figure 4. In a network diagram, there are basically three interactions:

- 1 user to user interaction
- 2 user to word interactions
- 3 words to words interaction.

Figure 4 TweetBoard's network mapping function (see online version for colours)



Frequently mentioned words can easily be identified, including those people who voiced them out as well as words linked to particular words. The mapping function also enables users to identify clusters of students who mention certain events, persons or organisations based on the words that they use and conduct analytical follow-up measures. Knowledge about graph theory and network analysis is crucial for an understanding of how subjects behave within a network. Further insights into internal network dynamics can be gained by calculating the 3 key centrality values, namely in/out degree, closeness and betweenness centrality. Insights such as the engagement of less out spoken students. This remains a challenge and more data needs to be collected before it can be conclusively proven.

Moving forward, we intend to further analyse students' in-class social networks, for example, to shed light on how influential particular student micro-bloggers are and how that might translate into class activity levels and learning outcomes (Weng et al., 2010) as well as their influence in getting less outspoken students to participate. Another interesting approach is *sentiment analysis* (Go et al., 2009; Vilares et al., 2015) which allows instructors to identify influential students who can make or break a class through positive, learning-enhancing or toxic tweets.

3.3 *Sponsor evaluation*

Towards the end of the assignment, a final presentation was done during which the Twitter platform development team presented the prototype they had developed. Assessment criteria included:

- 1 professionalism:
 - the team conducted its business in a professional manner
 - they were well prepared, helpful, cooperative, respectful and clear in their communications.
- 2 fulfilment of requirements:
 - the team completed all work described in the requirement document
 - all software has been installed and works properly, all documentation or reports are complete, and all other items are complete.
- 3 attention to quality and detail:
 - the team's deliverables (software, documentation, support services, reports, etc.) were carefully prepared, useful and user friendly
 - materials delivered are of high quality and appropriate to your needs
 - the team has advised you on any required project maintenance or further development.
- 4 overall usefulness of the project:
 - the team's project will be useful to you or your organisation and directly addresses the needs you expressed to the team.

The team excelled due to a high level of motivation, cohesiveness, a culture of hard working, innovation and sheer competence.

4 Conclusions

While empirical research on the impact of social media such as micro-blogging on students' learning effectiveness is still rare, our exploratory research on pedagogical tweeting via the newly developed TweetBoard platform suggests that Twitter is useful in supplementing blended learning approaches. Broadly speaking, micro-blogging in class can help students to create meaningful, collaborative learning outcomes and enables them to identify and tackle competency gaps. However, it is advisable to limit its usage in order to maximise its value added and to avoid class disruptions.

Both students and supervising Faculty involved in the project concluded that the newly developed TweetBoard application with its various functions has scalability in terms of pedagogical value added and research insights into learning behaviour and outcomes. TweetBoard effectively organises (Twitter) class discussions and helps to prioritise certain Tweets that are seen as worthy for a further in-depth discussion with the help of different tabs such as word cloud. The platform provides instructors with useful *analytics* to focus class discussions on essential discussion points and can increase students' participation. This was evident during a pilot event in a Leadership and Team Building course as described above where we experimented with pedagogical micro-blogging in the context of a blended learning format. Micro-blogging helps educators to find out more about students' thinking patterns, insights and concerns while class is in progress aimed at making both teaching and learning less mundane and more meaningful.

Analysing social media data such as course-related tweets in order to increase educational effectiveness represents an exciting field for further research. It is planned to initiate a new research data analytics project to further enhance the analytics function of TweetBoard as well as leveraging social network analysis to shed more light on the collaborative learning effectiveness of networked student micro-bloggers.

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