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Beyond the culture effect on credibility perception on microblogs

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Abstract. We investigated the credibility perception of tweet readers from the USA and by readers from eight Arabic countries; our aim was to understand if credibility was affected by country and/or by culture. Results from a crowd-sourcing experiment, showed a wide variety of factors affected credibility perception, including a tweet author's gender, profile image, username style, location, and social network overlap with the reader. We found that culture determines readers' credibility perception, but country has no effect. We discuss the implications of our findings for user interface design and social media systems.

Keywords: Credibility, Social media, Microblog, Culture.

1   Introduction

Social media provides an important information source for many people worldwide. Sixty-six percent of Facebook users and fifty-nine percent of Twitter users get some news from social media [11]. Over 85% of topics in Twitter are news [20]. Microblog posts, or tweets, provide a first alarm for news in emergency events such as an earthquakes [30]. In early 2011, Google started to incorporate people's social media status updates in its search engine results [10], indicating the importance of such content as socially relevant and timely sources of information.

In platforms built on user contributions, the information source on which the post is based cannot always be trusted. Social media suffers from unreliable data sources and rumors that can spread quickly, both of which can affect the credibility perception of social media platforms. Readers perceive the same content as less credible when it is posted on Twitter than on a website [31].

The way in which readers interact with social media to find information has changed over time. For instance, use of keyword search and hashtags to find information has increased. Such mechanisms allow readers to see content from previously unknown authors, which leads to credibility concerns [22].

The influence of culture on behavior has been well studied [16]. Readers' credibility perceptions are embedded in a specific social and cultural contexts, including individual and collective preferences, emotions, and other differences. Researchers have studied cultural differences in microblog credibility perception.

Yang et al. reported that readers from USA and China have significant differences in their credibility behavior [35]. However, these studies have examined a small numbers of countries, few readers or do not use the same microblog data for countries in their methodology. In this study, we aim to investigate the inter-relationship of culture and country and their effect on Twitter readers' credibility perception. We found that readers from different cultures have different credibility perceptions, but those from countries sharing similar cultural characteristics have similar perceptions.

2 Related work

Here, we describe current microblog credibility research, the research on culture and user's behavior in social media, and the gap in the current literature.

2.1 Microblog Credibility

Information credibility on the Web is commonly defined as a perception rather than as an objective measure of information quality [6]. Credibility is not about the information and sources as objects, but rather about how a reader judges information and source quality [7, 8]. A number of researchers have tried to assess the credibility of tweets in different ways, focusing on tweets [4, 21, 13] or tweet authors [26, 9, 12]. Other researchers have focused on building topical authority recommendation systems [29, 32]. Recent work has shown that credibility prediction results do not generalize well [3]; the classification accuracy of trained models has been overestimated. Understanding the factors that influence a reader's credibility judgment might improve model accuracy and increase generalization.

2.2 Microblog and Culture

Culture has a significant effect on behavior: culture was found to be a significant factor for predicting behavior in social questions and answers [36]. Previous research found significant differences in credibility judgments between microblog readers from the USA and China [35]. However, the research was not able to address if the measured credibility perception difference was due to country or culture.

Poblete et al. studied the behavior of millions of users from different countries using Twitter [28] considering use of hashtags, URLs, mentions, and retweets. The researchers found differences in use across countries of similar culture. Significant behavioral differences were found between users of different languages [33], even in languages of the same culture. Hong et al. compared users of different languages considering five behaviors: hashtags, URLs, mentions, retweets, and replies [17]. They found, for example that use of "Replies" varied within western culture, results were 50% for Dutch but only 36% for German, while within eastern culture, the results showed 59% for Korean and only 20% for Indonesian.

From the above studies we notice that there is ambiguity between the effect of culture and the effect of country on a social media user's behavior.

3 Methodology

We designed a study using a crowd sourcing platform to examine the credibility perception of readers of the American culture from the USA and of readers of the Arabic culture from countries located in the Middle East and North Africa where most people speak Arabic. The countries chosen are members of the League of Arab States:[3] Algeria, Egypt, Jordan, Morocco, Palestine, Tunisia, Saudi Arabia, and the United Arab Emirates. Saudi Arabia and the United Arab Emirates are representatives of the Arabic Peninsula region; Jordan and Palestine of the Levant region; Egypt of the Nile valley region; and Morocco, Algeria, Tunisia of the Maghreb. The populations of these eight countries make up 60% of all Arabic countries.[4]. The countries historically share the same "Arabic culture" [15, 34, 5, 24].

To examine the impact of culture and country on the credibility perceptions of readers in social media, we used metadata of tweet authors including gender, image, username, location, and network overlap. These features have previously been found to have significant effect on credibility perception [1, 22].

3.1 Factors examined

We next describe the author features used.

Gender Gender has been studied previously in blogs [2] where male authors were perceived to be more credible than female authors. Morris et al. found gender influences reader credibility perception [22]. They found that readers perceived male authored posts to be significantly more credible than female, similar to another study [35]. To differentiate between the two genders, an image of a male or female was used and usernames were selected that were applicable for each gender.
H1: Male authored tweets will be more credible than female tweets.
H1a: Culture and country will change the user's overall behavior towards the gender of the author.

Profile image Profile pictures affect readers' judgments [19] as observed in many microblog platforms (Twitter and Reddit). Different types of profile images have different credibility judgment effects. In our study, we followed the methodology of [35] limiting images to two styles: a general (anonymous) image representing male or female, and real photos for both genders. All real photos pertained to each culture, showing the headshot of a young adult. For Arabic

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[3] http://www.lasportal.org/en/aboutlas/Pages/CountryData.aspx
[4] https://en.wikipedia.org/wiki/Geography_of_the_Arab_League

authors, we used real images for Arabian male and female, and for authors from the USA, we selected Caucasian male and female photos, as in Fig. 1.

H2: Real photos will be perceived as more credible than anonymous.

H2a: Photos indicating culture and country will affect credibility perception.

Username The name presented next to an author profile image has been found to be effect readers' credibility perception. Pal and Counts found the perception of readers towards the quality of the content are often based solely on the author's name [27] and tweets with a username are rated more highly than anonymous tweets. In this study, two name styles were used: a topical username (e.g. Politics_News) and an Internet style name (e.g. Healthy_24), which is neither traditional nor topical.

H3: Topical usernames will be more credible than Internet style.

H3a: Usernames indicating culture and country will affect credibility perception.

Location The author's location has been found to be an important factor for microblog credibility perception, especially in political topics [1]. Authors from the same country in which an event occurred were perceived as more credible by readers than those with no location indicated in their tweets. Another study used liberal and conservative locations to study the interaction between location of authors and user microblog credibility perception [35].

In our study we considered the size of a location: authors from large locations tend to share information more than those from small locations [19]. Each tweet identified the location of the author, including the name of a country/state and city. For Arabic tweets, we chose two large cities and two smaller cities for each country, For example, the large cities in Egypt were Cairo and Alexandria and the small cities were Damietta and Arish. For U.S. tweets, we adopted a methodology from past research [35]. We chose 16 states: two large cities were chosen from each of eight states and two small cities from each of the other eight. For example Seattle, Washington (large) and Manti, Utah (small). Wikipedia define large and small cities based on population.

H4: Tweets authored in large locations will be perceived as more credible than those authored in small locations.

H4a: H4 will be affected by culture and country.

H4b: Location is a topic-dependent factor, as found by [1]. Location styles will vary based on the topic with significant interaction.

Network overlap Twitter provides a social network among users defined by users following other users. Poblete et al. studied social connections among Twitter users from ten different countries, and found the connectivity among users in some countries such as South Korea, Japan, and Canada was significant compared to other countries such as the USA [28].

We want to measure the effect of connectivity on the credibility perceptions of readers. We used two conditions: overlap and no overlap, inspired by [35]. We

stated to readers "Imagine this is the number of your friends who are following this author". We generated a random number of friends, as shown in Fig. 1.

H5: Tweets authored by users with a network overlap will be more credible than tweets with no overlap.

H5a: Culture and country will make significant interaction with **H5**.

H5b: Overlapping styles will vary based on topic with significant interaction, this has been found in past work [35].

B_Easy !#
U.S Government bans dealing with Russian companies that are implicated in cyber theft.
bit.ly/1M51Qde
Essex, Vermont (imagine 2 of your friends in Twitter are following him)

(a)

Health&Medical
Blood sugar and cholesterol are 30% higher for smokers compared to non-smokers.
wb.md/1fToNI0
Watertown, South Dakota

(b)

الموسوعة الطبية
اللابتوب يمكن أن يعكس الأشعة فوق البنفسجية ويسبب سرطان الجلد، حسب دراسة حديثة من مستشفى جون هوبكينز.
bit.ly/1JYdPTe
السلط الأردن (اعتبر 5 من أصدقائك في تويتر يتابعونه)

(c)

الساعة_و
منظمة حقوق الإنسان تعقد مؤتمراً كبيراً في لندن يحضره العديد من الشخصيات السياسية لمحاولة وقف أحكام الإعدام في مصر.
bit.ly/1Ln6thz
القاهرة, مصر (اعتبر 3 من أصدقائك في تويتر يتابعونه)

(d)

Fig. 1: Sample tweets: a) USA, politics, male, real photo, Internet style username, large location, overlap. b) USA, health, female, anonymous photo, topical style username, small location, no overlap. c) Arabic, health, male, real photo, topical style username, small location, overlap. d) Arabic, politics, male, anonymous photo, Internet style username, large location, overlap.

4 Experimental design

We followed the methodology developed by Yang et al. [35]. We examined five different author factors: Gender, Location (large, small), User name (Topical, Internet), Profile image (general, photo), and Network overlap (overlap, no overlap). For each factor there were two conditions. Using a Latin Square design, the number of tweets will be 32 ($2 \times 2 \times 2 \times 2 \times 2$). For each language, we authored 32 political tweets and 32 health tweets, including two topics to study the interaction between topic and features across cultures. Each participant from each culture read only one type of tweet, either politics or health. Accordingly, we authored 128 tweets for the purpose of this experiment. All political tweets were about local events in the respective countries to make the tweet more relevant to the participants. The health tweets were written in English and the same tweets translated to Arabic [22, 35].

Our experiment consisted of two parts: judging tweet credibility, and a survey on reader demographic information. When judging credibility, users were

asked whether they thought "This tweet contains credible information". They answered using a 7-point Likert scale from strongly disagree to strongly agree. Each participant needed to complete 32 tweets on one topic and tweets were presented randomly.

4.1 Tweet contents

In writing the simulated tweets, all tweets were false but plausible, thus eliminating participants' previous knowledge affecting their judgments. Groups of native Arabic and English speakers reviewed all tweets to ensure there were no grammatical mistakes that would affect user's credibility judgments. We repeated the checking and re-authoring process until all tweets were deemed ready and plausible. This method has been used by prior studies [1, 22].

All author features (gender, image, username, location and network overlap) were randomly combined for each tweet. Location and network overlap needed to be added to the tweet. Location was automatically generated and we added this manually in the exact way of a tweet appearance. We presented network overlap information next to location. Each username, photo and location was presented only once, so we prepared a sufficient set for each factor.

4.2 Experiment

We recruited participants via the CrowdFlower platform[5]. The platform gives an option to choose participant countries. We restricted participants to the nine studied countries. Note Palestine is as defined as a country by CrowdFlower. We specified language capability for the Arabic participants to be Arabic. Moreover, each participant was asked to specify his/her language. Only those who responded "Arabic" were further considered in this study. For participants from the USA, only those who nominated their first language as "English" were used.

5 Results

We received 30,336 judgments from 948 participants. Table 1a shows the spread of participants within the two cultures and the Arabic countries. Table 1b shows the distribution of participants across the two cultures was almost balanced, the gender, age distributions, and educational levels between the two cultures have the same ratio. We used a mixed design ANOVA (within and between predictors) to analyze and test the effect of all factors and interaction with credibility rating of tweets. We applied the mixed designed ANOVA twice, between cultures (Arabic and USA), and between the Arabic countries.

Table 2 shows ANOVA results for author factors and their interaction with culture, country, and topic. ANOVA analyses were performed to test all hypotheses and the impact of our experimental manipulations on users' credibility

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[5] https://www.crowdflower.com

Table 1: Distribution and demographics of the participants

(a) Participants' distribution across cultures and countries

Culture	Freq.	Country	Freq.
Arabic	543	Saudi Arabic (SAU)	56
		United Arab Emirates (UAE)	35
		Jordan (JOR)	34
		Palestine (PSE)	22
		Egypt (EGY)	243
American	405	Morocco (MAR)	24
		Algeria (DZA)	78
		Tunisia (TUN)	51

(b) Participants' demographics across cultures and countries.

Demographic Item	Arabic (543)	American (405)
Male	72%	63%
Female	28%	37%
18-24	35%	35%
25-34	38%	37%
35-44	15%	17%
45-above	12%	11%
Less than high school	2%	1%
High school	14%	11%
Diploma	22%	32%
Bachelor	49%	44%
Master degree	11%	11%
PhD.	2%	1%

judgments, where the demographic variables of gender, age and educational level were controlled. We followed up with pairwise t-tests when appropriate and Bonferroni corrections were used to mitigate the effect of multiple comparisons.

Table 2: Comparing culture (C) and Arabic countries(A). $*p<0.05$ and $\dagger p<0.001$.

Factor	Culture			Arabic cntry			Factor	Culture			Arabic cntry		
	DF	F_{value}	P	DF	F_{value}	P		DF	F_{value}	P	DF	F_{value}	P
C/A	1	9.45	0.002*	7	1.34	0.225	C/A*Topic	1	0.913	0.340	7	2.11	0.040*
Topic	1	88.17	$0.000^\dagger$	1	17.80	$0.000^\dagger$	Topic*Gender	1	8.47	0.004*	1	0.021	0.884
Gender	1	157.02	$0.000^\dagger$	1	31.77	$0.000^\dagger$	Topic*Image	1	0.886	0.347	1	0.110	0.741
Image	1	15.08	$0.000^\dagger$	1	43.44	$0.000^\dagger$	Topic*Username	1	0.886	0.690	1	3.08	0.079
Username	1	70.58	$0.000^\dagger$	1	20.59	$0.000^\dagger$	Topic*Location	1	8.07	0.005*	1	9.94	0.002*
Location	1	0.25	0.617	1	1.30	0.253	Topic*Network overlap	1	10.11	0.002*	1	59.05	$0.000^\dagger$
Network overlap	1	39.85	$0.000^\dagger$	1	2.13	0.145	C/A*Topic*Gender	1	17.02	$0.000^\dagger$	7	0.371	0.919
C/A*Gender	1	1.15	0.284	7	2.24	0.030*	C/A*Topic*Image	1	3.61	0.58	7	1.27	0.259
C/A*Image	1	84.18	$0.000^\dagger$	7	1.32	0.236	C/A*Topic*Username	1	12.35	$0.000^\dagger$	7	1.89	0.068
C/A*Username	1	0.002	0.962	7	0.735	0.642	C/A*Topic*Location	1	31.13	$0.000^\dagger$	7	0.838	0.556
C/A*Location	1	0.759	0.384	7	1.73	0.098	C/A*Topic*Network overlap	1	116.22	$0.000^\dagger$	7	1.71	0.103
C/A*Network overlap	1	5.98	0.015*	7	1.11	0.354							

For culture and country, we show the result of each hypothesis from the ANOVA model by presenting the means with p-value. Where the interaction was significant, we checked the direction of differences and report means with p value in tables for readability. We use the country's code of Arabic countries as in Table 1a, instead of their complete name.

5.1 Interaction of Culture with author's profile features

Gender (H1:supported) Readers regarded tweets from males (mean $_{male}$ = 4.63) as more credible than female tweets (mean $_{female}$ = 4.34) with $p<0.001$.

Table 3: Interaction culture with image and network overlap, *p<0.05, †p<0.001.

(a) Image vs Culture.

	Arabic	American	$P_{two\ cultures}$
Real	4.69	4.45	$0.000^{†}$
Generic	4.45	4.35	$0.000^{†}$
$P_{two\ styles}$	$0.000^{†}$	$0.000^{†}$	-

(b) Network overlap vs Culture.

	Arabic	American	$P_{two\ cultures}$
Overlap	4.61	4.48	0.03^{*}
No_overlap	4.54	4.33	$0.000^{†}$
$P_{two\ styles}$	0.030^{*}	$0.000^{†}$	-

(H1a:Not supported) The interaction between culture and gender was not significant (p=0.284) and culture did not affect readers' credibility perceptions according to an author's gender. We explored the effect of topic interaction with gender and culture and found a significant interaction (p<0.001). The two cultures in politics saw male authored tweets significantly more credible than female authored, while in the health topic American readers were more accepting of female tweets than were Arabic readers.

Image (H2: supported) The difference in reader perception of credibility due to real or generic photos was significant (p<0.001). People perceived tweets with real photos (mean $_{Photo}$ = 4.52) as more credible than those with generic (mean $_{Generic}$ = 4.45).
(H2a: supported) The interaction between culture and profile image was significant (p<0.001). The real image was perceived significantly more credible by Arabic readers than American (Table 3a) while Americans were more accepting of the use of an anonymous image than Arabic readers.

Username (H3: supported) Tweets with a topical author name were judged to be more credible (mean $_{Topical}$ = 4.57) than tweets with an Internet style (mean $_{Internet}$ = 4.40, p<0.001).
(H3a: Not supported) The interaction between culture and username was not significant (P=0.962). However, adding topic to the interaction between culture and username made the interaction significant (P<0.001). In politics, Arabic readers were more tolerant of the use Internet style than Americans, while the opposite behavior happened in health.

Location (H4: not supported) Tweets authored in large and small locations have no effect on readers' credibility perceptions (mean $_{large}$ = 4.49, mean $_{small}$ = 4.48, P =0.617).
(H4a: Not supported) The interaction between location and culture was not significant (P=0.384). However, the interaction between culture, location, and topic (p<0.001) was significant. In Arabic culture, large locations were perceived to provide more credible tweets than small locations regarding the political topic,

Table 4: Location vs Topic and Network overlap vs Topic, *p<0.05, †p<0.001.

	Location			Network overlap		
	Large	Small	P two styles	Overlapping	No overlapping	P two styles
Politics	4.26	4.20	0.014*	4.26	4.20	0.021*
Health	4.73	4.77	0.112	4.83	4.66	0.000†
P two Topics	0.000†	0.000†	-	0.000†	0.000†	-

while small locations were the most credible in health topics. In both topics there was no difference between the two styles in U.S. culture.

(H4b: Supported): Interaction between location and topics is significant (p<0.05) in politics, a large location was perceived to have a higher credibility than a small location, the two locations' styles showed no difference in credibility for the health topics, Table 4 refers.

Network overlap (H5:supported) The difference between tweets authored by someone having or not having a friend connection was significant (mean $_{overlap}$= 4.54, mean $_{no\ overlap}$= 4.43, p<0.001).

(H5a: supported) The interaction between cultural context and network overlap was significant (p<0.05). Both cultures perceived authors with an overlap to be significantly more credible than those without, see Table 3b. However, American readers were more affected by network overlap than Arabic as they found that overlapped tweets were significantly more credible than non-overlapped, compared to less significant effect between the two styles in Arabic culture.

(H5a: supported) The interaction between network overlap and topic is significant (p<0.01). In the health topic, there was a large difference between the two styles as overlapped tweets were more credible than those with no overlap. However, in politics the difference between the two styles was small when compared with the health topic, see Table 4.

5.2 Interaction of Arabic Countries with author's profile features

Gender (H1:supported) Male authored tweets were more credible than female tweets (mean $_{male}$ =4.68, mean $_{female}$= 4.42, p<0.001).

(H1a: supported) The interaction between country and gender was significant (p=.030). Credibility ratings differed significantly between male and female authors (p<0.001) in some countries (DZA, EGY, SAU and TUN), other countries had the same gender credibility perceptions.

Image (H2: supported) Tweets from authors with a real image were more credible than tweets from authors with an anonymous image (mean $_{photo}$ =4.66, mean $_{generic}$= 4.44, p<0.001).

(H2a: not supported) The interaction between country and profile image was

Table 5: Location vs Topic, Network overlap vs Topic for Arabic, *p<0.05, †p<0.001.

	Location			Network overlap		
	Large	Small	P two styles	Overlapping	No overlapping	P two styles
Politics	4.42	4.27	0.000†	4.24	4.46	0.000†
Health	4.72	4.79	0.214	4.92	4.59	0.000†
P two Topics	0.004*	.000†	-	0.000†	.178	-

not significant (p=0.236), and the effect of tweets' topics on interaction between country and image was also not significant (p=0.698).

Username (H3: supported) A topical username style was more credible than an internet username style (mean topical = 4.64, mean internet = 4.46, p<0.001). **(H3a: not supported)** The interaction with country did not show any significant difference (p=0.642) and all countries were consistent with this finding.

Location (H4: not supported) No significant differences were found between the two location types, Arabic readers viewed tweets from large and small locations as having the same credibility level (mean large = 4.57, mean small = 4.53, p=0.098. **(H4a: not supported)** The interaction of country with location was not significant (p=0.192). **(H4b: supported)** Interaction between location and topic was significant (p<0.01). Large locations as sources were perceived as more credible than small locations significantly in political tweets, While both location types had the same credibility rating regarding the health topic, as shown in Table 5.

Network overlap (H5: supported) Overlapping styles were rated at the same credibility level, (mean overlap= 4.58, mean no overlap= 4.52, p>0.05). **(H5a: not supported)** We found no effect of the difference in countries on the overlapping factor (p=0.354). **(H5b: supported)** The interaction between network overlap and topic was significant (p<0.001), the overlapped tweets were perceived to be highly credible regarding the health topic, while no overlapped tweets were perceived highly credible in politics topic, as in Table 5.

6   Discussion and conclusions

We examined the extent to which differences between cultures and countries interact with Twitter profile features (author's gender, profile image, user name, location, and network overlap) to affect readers' credibility judgment. All author's factors included in our study were shown to have a distinct effect on

users' credibility judgments. The results of this study indicate that, regardless of country, culture has the main effect of users credibility assessment. We notice that the interaction between readers in Arabic countries and the factors (except gender) were not significant, even for three-way interactions (countries -vs- factor -vs- topic). Interaction of culture with the factors had a significant two- or three-way interaction. This finding confirms the hypothesis that culture has a strong influence on users' behavior in social questions and answers [36] and credibility perception of users in social media [35]. However, our results indicate that "culture" is not necessarily restricted to one country as two previous research findings, and many countries may be included under one culture.

At the two levels of our classification (culture and country), location and network overlap were topic-dependent factors. Location type was validated to be effective in support of user credibility perception in political tweets. This result confirms the finding of Aladhadh et al. that a tweet's location impacts credibility in political tweets [1]. Although few users include their location in their posts, location can be determined through analyzing tweets. This is an area of current research [14, 23].

Network overlap was found to be an important factor in health tweets for Arabic readers, for Americans credibility for political tweets was important. Network overlap is culture and topic-dependent. Therefore, it is important to focus on such overlap to help users determine their credibility judgments. Topic might be the most influential factor on users' credibility judgments. It is necessary to build categories for proportion of features in different microblog topics and use that to enhance credibility of retrieved results in social media. This is similar to the categories of information distribution in different crises [18, 25].

We sought to find readers' culture and country influence their credibility perceptions, and how the perceptions interact with different features common in social media. Culture can be used to customize social search engines to help assess content credibility, but including a country's attributes along with its culture can be more effective. Moreover, profile features have significant effect on credibility judgments by users. These findings will help designers of interfaces and algorithms about readers' needs. With the large impact of culture on users' credibility perceptions as found in this study, a number of limitations such as corporate accounts were not included in this study. Furthermore, studying the interaction between culture and other demographic factors in credibility perception can affect the behavior of readers. That is an area of future research.

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