

Timing is Everything: Comparing Synchronous and Asynchronous Modes of Twitter for Teacher  
Professional Learning

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## Purpose and Research Questions

Teachers use the social networking site Twitter for professional learning (Carpenter & Krutka, 2014, 2015; Forte, Humphreys, & Park, 2012; Visser, Evering, & Barrett, 2014). One notable mode of teacher activity on Twitter is participation through *hashtags*, keywords or phrases preceded by a # symbol. Hashtags can be used as an index, connecting a tweet with others on the same subject and allowing users to find all tweets connected with that subject. Hashtags for teacher professional learning include those focused on education broadly (e.g., #edchat; Gao & Li, 2017), on specific content areas (e.g., #sschat for social studies; Krutka & Milton, 2013), or on particular regions, including American states (e.g., #miched for Michigan; Rosenberg, Greenhalgh, Koehler, Hamilton, & Akcaoglu, 2016).

One understudied aspect of teacher-focused hashtags is potential differences between *synchronous* (i.e., immediate-response) and *asynchronous* (i.e., delayed-response) communication using these hashtags. Many hashtags are associated with *Twitter chats*, in which participants log on at the same time to participate in a real-time conversation (Carpenter & Krutka, 2015; Gao & Li, 2017). Although chats may account for a substantial amount of the activity on a hashtag, the hashtag often remains active outside of the dates and times set aside for synchronous communication (Rosenberg et al., 2016). That is, participants continue to use the hashtag for general broadcasting or delayed conversations. However, there has been little work in the extant literature to determine whether and how these synchronous and asynchronous modes differ.

The purpose of this study is to explore how activity differs between synchronous and asynchronous uses of a hashtag for teachers in the American state of Michigan—#miched. In doing so, we explore how a single technology has been repurposed in different ways and how

these adaptations may represent distinct contexts within a broader social sphere. To carry out this purpose, we ask the following research questions:

- RQ1: How much *activity* in #miched is associated with synchronous and asynchronous modes?
- RQ2: How does activity in #miched differ between modes in terms of *content*?
- RQ3: How does activity in #miched differ between modes in terms of *interaction*?
- RQ4: How does activity in #miched differ between modes in terms of *portals*?

### **Background and Framework**

In this study, we frame teachers' professional learning as a complex act mediated by both technological and social factors. This view can be traced back to Vygotsky (1978), who described the role of social relationships in teaching and learning and the role of tools, signs, and symbols in mediating these processes. Building on Vygotsky's work, Scribner and Cole (1978) invited scholars to consider *practices*—"goal-directed sequence[s] of activities, using particular technologies and applying particular systems of knowledge" (p. 457). Different practices—typically referred to in terms of literacy or literacies—emerge from different social groups or from the use of different technologies (Mills, 2010). For example, Greenhow and Gleason (2012) asserted that using Twitter can be considered a literacy practice—a "constantly evolving co-constructed conversation" (p. 472) shaped by context and social conventions.

Different technologies lead to different practices in that they *afford* and *constrain* certain behaviors (Borko, Whitcomb, & Liston, 2009; Kennewell, 2001). For example, technologies that allow for delayed, asynchronous conversation can lend themselves to deeper reflections (Garrison, 2003; Johnson, 2006). Conversely, technologies that allow for immediate, synchronous communication can afford quicker impression formation and increased social

presence (Cao, Griffin & Bai, 2009). Two people may therefore choose to chat via teleconferencing software in order to get to know each other but later have a conversation via email when discussing a serious subject requiring some thought.

However, in the case of Twitter, a single technology is being used for both synchronous and asynchronous communication, making it likely that the social context of the technology—and not its design features—is shaping how it is being used. Regardless of its affordances and constraints, it is the individuals and groups employing a technology that ultimately determine how it is used (Veletsianos, 2017); a technology may therefore be used in different ways by different people or in different contexts (Kranzberg, 1986). Thus, because Twitter is being used in both synchronous and asynchronous modes, we may expect that there are different social contexts associated with these different applications.

In this paper, we distinguish between social contexts using terms associated with *social semiotic spaces* (SSS). Gee (2004, 2005) proposed the SSS as an alternative to other conceptions of social learning contexts that was more flexible and therefore better suited for studying online social learning; SSS components include the *content* being discussed within a context, the *interactions* happening within that context, and the *portals* by which that context is accessed. Thus, different social contexts informing synchronous and asynchronous modes of Twitter may differ in terms of the *content* of tweets, the ways in which users *interact* with those tweets, and the *portals* (e.g., hashtags and URLs) users employ to connect with or link to spaces where learning is happening.

### **Data Sources and Methods**

We used a range of *digital methods* (Snee, Hine, Morey, Roberts, & Watson, 2016) to collect data. First, we collected tweets using the #miched hashtag between September 1, 2015

and August 31, 2016 with a Twitter Archiving Google Sheet (Hawksey, 2014). We then used the Twitter application programming interface and Web scraping (Munzert, Rubba, Meißner, & Nyhuis, 2015) to collect additional information. Our final dataset included tweets and associated metadata, such as Twitter accounts, timestamps, and evidence of interaction. We then manually coded tweets that had been composed during synchronous chats.

We used this coded data to answer our four research questions. To measure the amount of #miched activity associated with synchronous and asynchronous modes (RQ1), we counted the number of tweets composed during each mode and the number of Twitter accounts active during each mode; we then compared these numbers using chi-square tests. We also determined the mean number of tweets composed per account in each mode and compared these numbers with a *t*-test. To determine differences in content (RQ2), we used the dictionary-based text analysis software Linguistic Inquiry and Word Count (LIWC; Pennebaker Conglomerates, 2015) to determine the psychological constructs present in original tweets (i.e., not retweets, replies, or *quote tweets*). We then calculated the mean for key constructs from the LIWC for each mode and used *t*-tests to compare them. To determine differences in interaction (RQ3), we used *t*-tests to compare the mean number of *likes* and *retweets* (two ways of interacting with tweets) as well as *replies* and *mentions* (two ways of interacting with Twitter users) associated with original tweets in each mode. We also used a chi-square test to compare the number of *quote tweets* (a way of referencing and commenting on other tweets) in each mode. To determine differences in portals (RQ4), we used *t*-tests to compare the mean number of *URLs* and *hashtags* included in original tweets in each mode.

## Results

### RQ1: Activity

We collected 89,943 tweets tagged with #miched. Of these, 70,576 were sent during asynchronous times, and 19,367 were sent during synchronous Twitter chats, a statistically-significant difference ( $\chi^2 = 29,155.8, p < .001$ ). Figure 1 shows the number of asynchronous and synchronous tweets per day over this time. Similarly, 9,755 separate Twitter accounts participated in #miched during asynchronous times, whereas 1,403 accounts participated during synchronous chats, another significant difference ( $\chi^2 = 6,251.6, p < .001$ ).

### **RQ2: Content**

Our LIWC analysis found significant differences between the content of tweets composed during asynchronous and synchronous times (see Figure 2). For example, during synchronous times, more original tweet text contained terms associated with constructs representing *affect* ( $t = 30.487, p < .001, d = .37$ ), *social* ( $t = 33.322, p < .001, d = .40$ ), and *cognitive processing* ( $t = 49.795, p < .001, d = .60$ ). In contrast, asynchronous original tweets are more associated with the *personal concerns—work* ( $t = 1.546, p < .001, d = .02$ ) construct.

### **RQ3: Interaction**

Each of the forms of interaction we considered in this study saw significant differences in how they were used during synchronous and asynchronous modes (see Figure 3). On average, an original tweet in synchronous chats received more *likes* ( $t = 17.838, p < .001, d = .22$ ) and *replies* ( $t = 29.767, p < .001, d = .36$ ). In contrast, an original tweet in asynchronous times received—on average—more *retweets* ( $t = 25.469, p < .001, d = .31$ ) and included more *mentions* ( $t = 63.776, p < .001, d = .77$ ). Furthermore, 8,468 quote tweets were composed during asynchronous times, significantly more than the 1,465 quote tweets composed during synchronous times. ( $\chi^2 = 4,937.3, p < .001$ ).

### **RQ4: Portals**

Our analysis suggests that, on average, original tweets composed during asynchronous times contain more portals to learning spaces than those composed during synchronous chats (see Figure 4). That is, asynchronous original tweets contain significantly more URLs ( $t = 126.77, p < .001, d = 1.53$ ) and hashtags ( $t = 96.393, p < .001, d = 1.17$ ) than synchronous original tweets.

### Discussion and Significance

Our results demonstrate clear differences in activity in the #miched hashtag space on Twitter. Synchronous and asynchronous uses of #miched during the 2015-2016 school year differed not only in terms of general activity but also the content, interaction, and portals associated with that activity. These results lead us to conclude that there are two social contexts in #miched: one dominated by social interaction and the other by content dissemination.

Synchronous uses of #miched appear to be chiefly associated with *social interaction*. Synchronous use of #miched was associated with more *likes* and *replies*. Likes may represent a way for Twitter users' to affirm or endorse others' ideas quickly—an important consideration when providing social support in a synchronous setting. The higher number of replies associated with synchronous tweets suggests the presence of genuine conversations during synchronous chats. Furthermore, using LIWC, we found the content of tweets during chats to be higher in terms associated with affect, social constructs, and cognitive processing; this suggests a higher intensity and seriousness of conversations during synchronous times, as opposed to just broadcasting ideas.

In contrast, asynchronous times were associated more with *content dissemination*. The higher use of *retweets* and *mentions* during asynchronous times may be indicative of strategies to increase the audience of a particular tweet—retweets allow Twitter users to repost ideas to their

own networks, and mentions allow an original tweeter to invite the attention of specific people (who may then engage in further dissemination). That asynchronous uses of #miched are associated with more overall activity in terms of total number of tweets and tweeters may suggest the success of these strategies; however, it should also be noted that synchronous chats represent a relatively small proportion of the time represented in the study period. Furthermore, the higher rate of URLs suggests that #miched participants are using asynchronous times to share more artifacts and resources, while the higher rate of hashtags may represent the use of more keywords in order to draw attention from people outside of the #miched space.

These distinct-but-complementary uses of the #miched hashtag are significant in the context of our evolving understanding of social connections in the age of the Internet. Theoretical conceptions of online community and social interaction range from tight-knit groups with frequent interaction to looser networks that nonetheless provide real value (Gruzd, Wellman, & Takhteyev, 2011); this distinction also exists in the literature on professional learning within education, with some scholars referring to *communities* of teachers that work closely together (Darling-Hammond & McLaughlin, 1995; Wenger, 1998) and others describing informal *professional learning networks* through which teachers obtain access to knowledge and resources (Couros, 2010; Trust, Krutka, & Carpenter, 2016). Our results suggest that there is value in both of these conceptions and, indeed, that they may exist in parallel within the same technological space. Teachers may find value in participating in hashtags during both asynchronous times and synchronous chats; however, they will also need to learn—and appreciate—the distinct social contexts and practices associated with each use.



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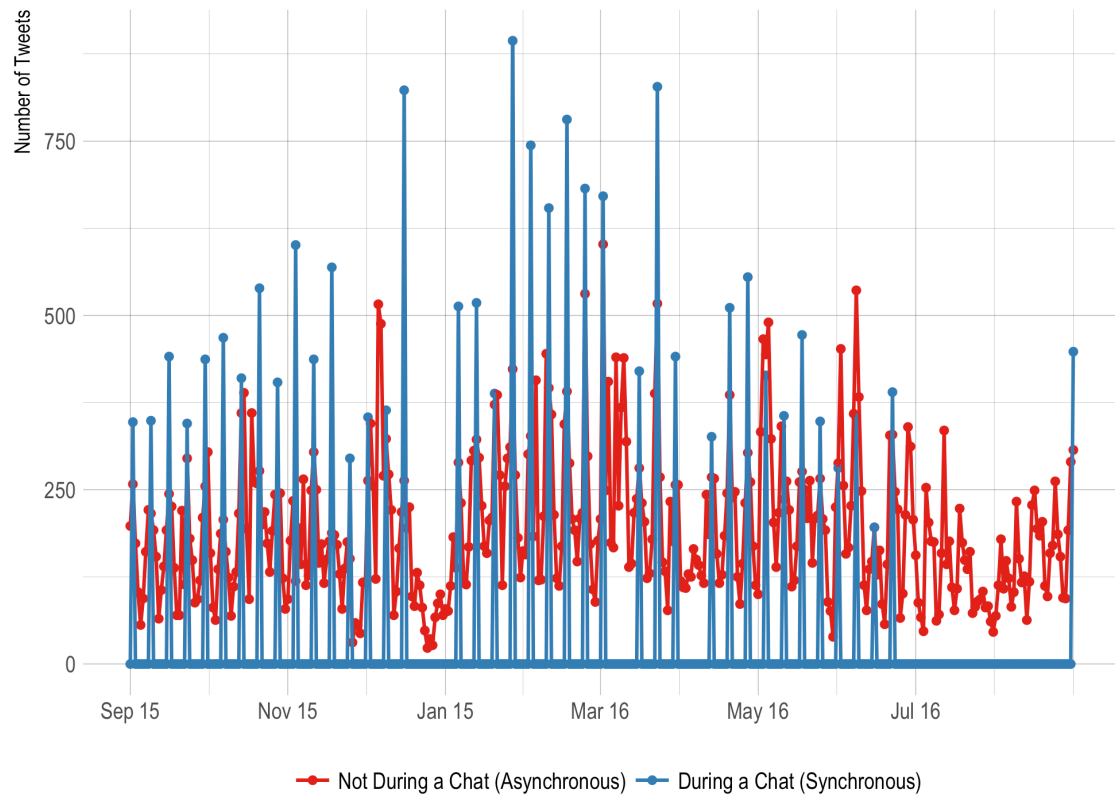
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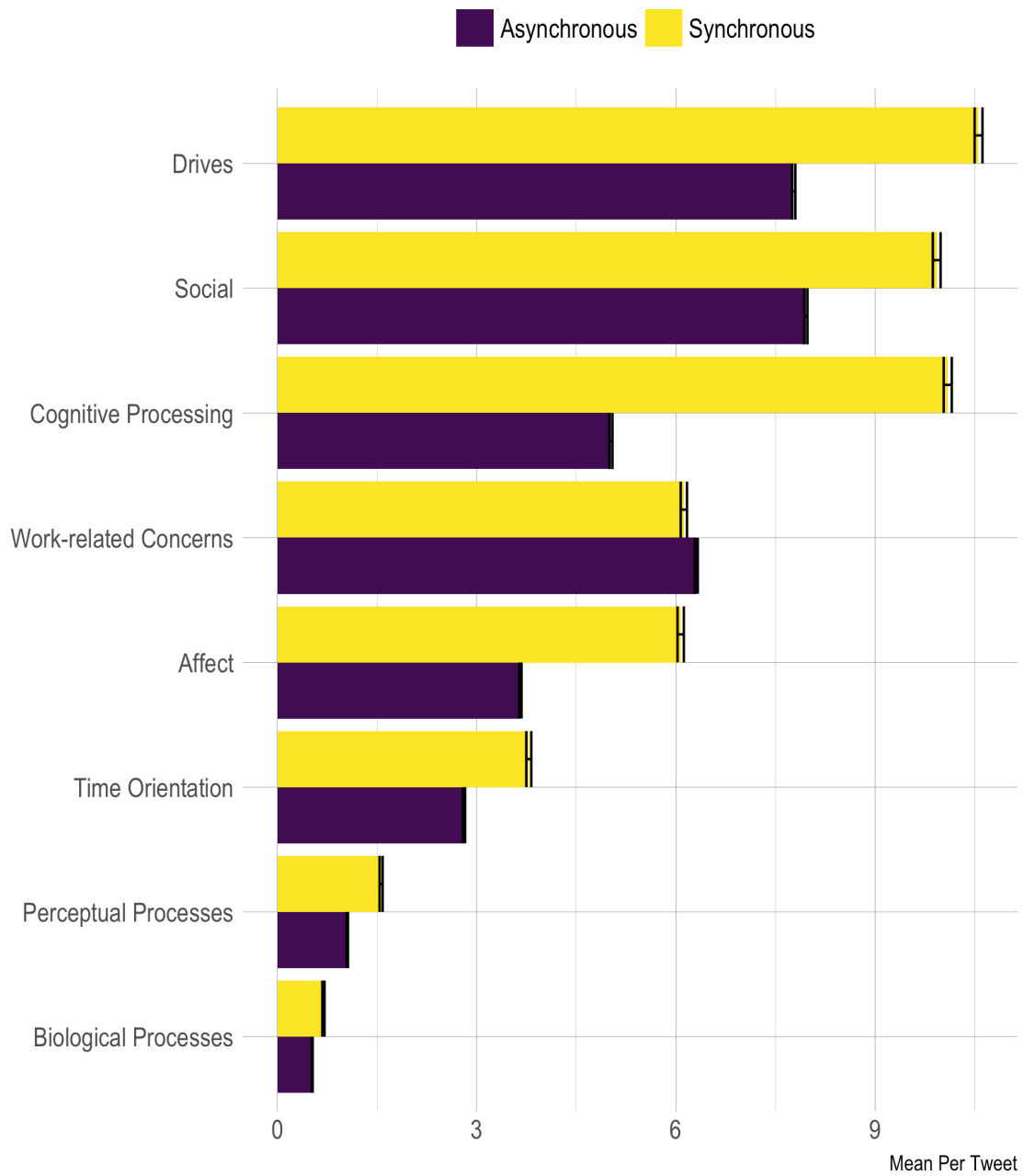
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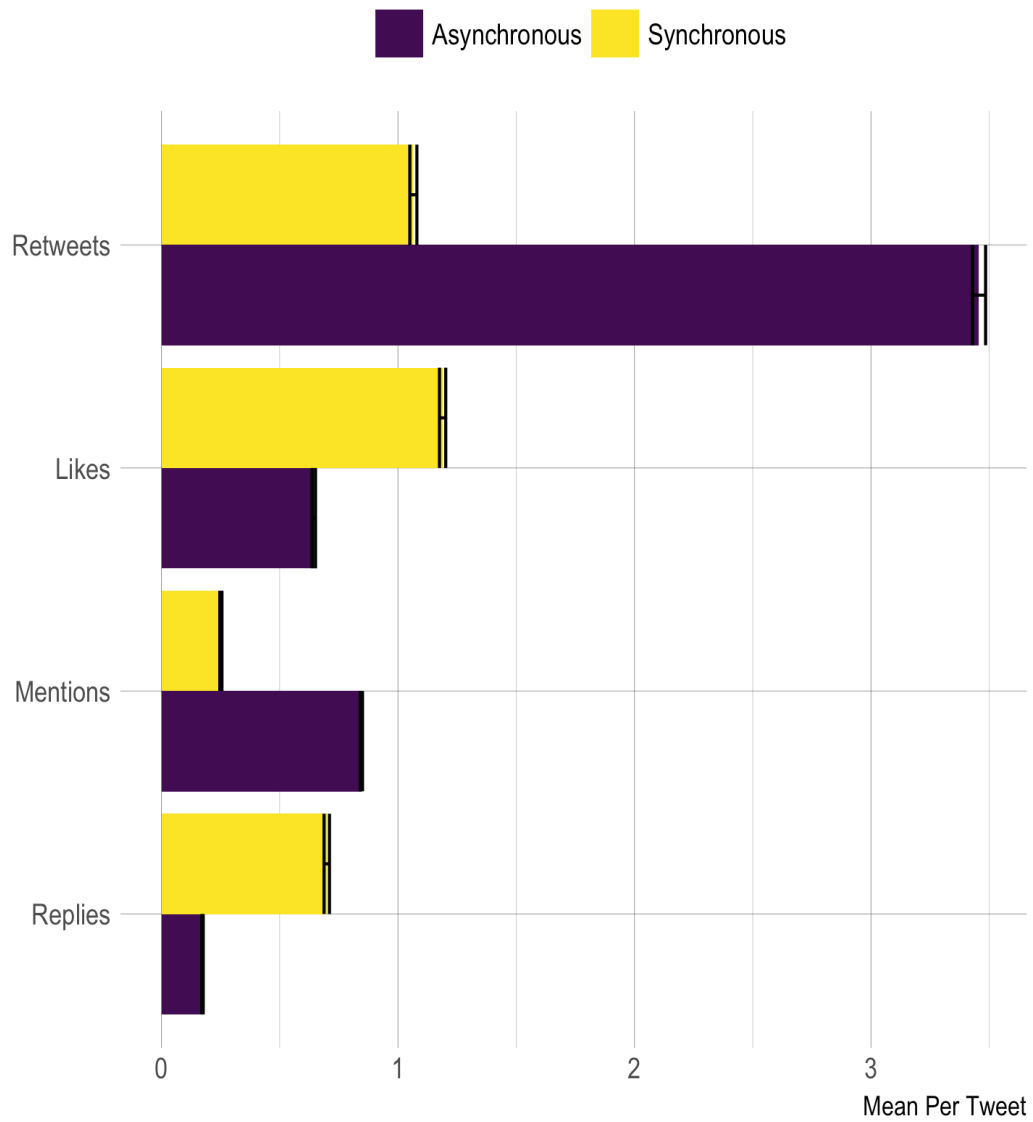
## Figures



*Figure 1.* Time series of the number of asynchronous and synchronous tweets using #miched per day during the 2015-2016 school year.



*Figure 2.* Differences in content measured through LIWC constructs for asynchronous and synchronous original tweets in #miched.



*Figure 3.* Differences in average interactions per original tweet for asynchronous and synchronous #miched tweets.

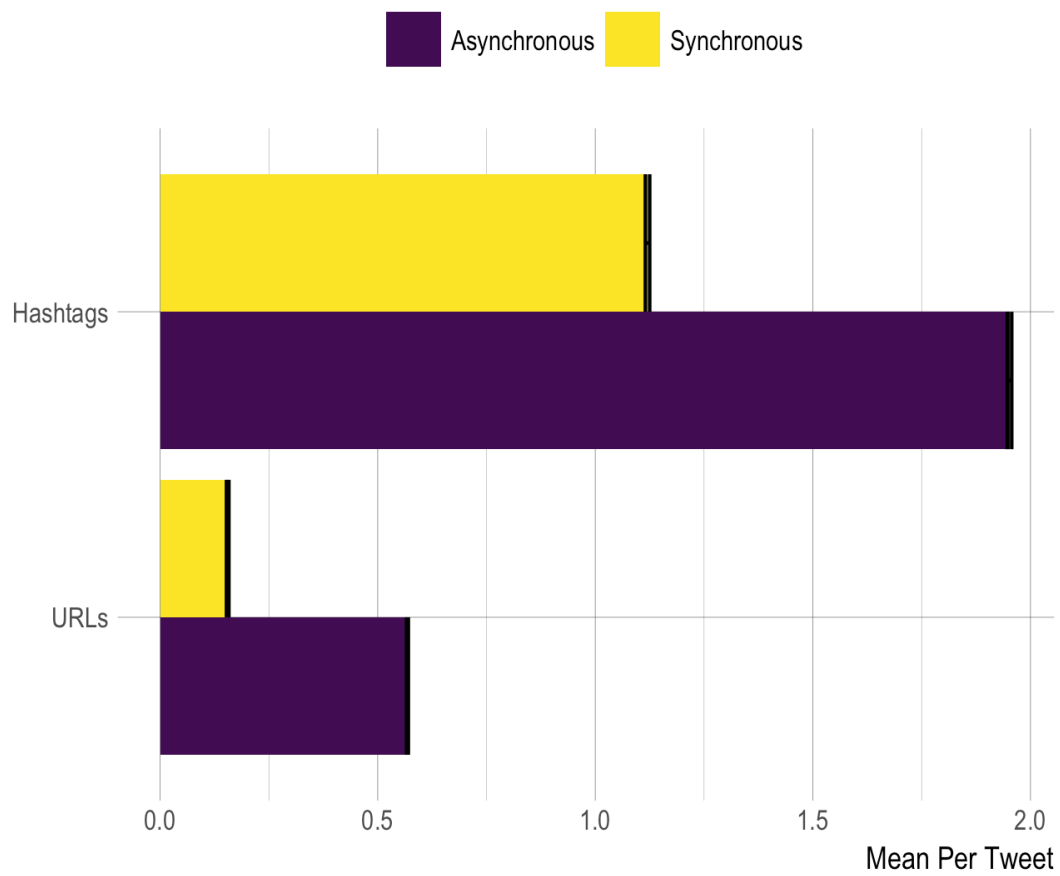


Figure 4. Differences in *portals* for asynchronous and synchronous original tweets in #miched.