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Sorting a public? Using quali-quantitative methods to interrogate the role of algorithms in digital democracy platforms

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ABSTRACT

Following concerns about social media's role in politics (fostering polarization and spreading disinformation), many activists and civic hackers have developed alternative digital democracy platforms for both deliberation and the representation of public opinion. But how are we to study the role of these platforms, and in particular, their algorithms in the development of issues and the publics that gather around them? This article employs a simple quali-quantitative data visualization to study how a particular digital democracy platform, vTaiwan (an implementation of Pol.is – a tool for generating opinions and consensus about public issues) – formats political participation. We investigate how one particular issue (Uber legalization) was formed and reformed by users, moderators, and algorithms on the vTaiwan platform over time. While the algorithm sorted opinions into a binary of pro and anti-Uber positions, we find that the comments themselves and their sequence suggest more nuanced positions and the potential for dialogue. We argue that vTaiwan may be limited by its focus on simple quantitative data points (positive or negative votes as opposed to the texts themselves) and a forced separation of participants into in-or-out opinion groups. This study contributes to critical algorithm studies and digital democracy studies by offering an effective way to analyse the role of algorithms in democratic politics.

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Publics; quali-quantitative methods; algorithms; social media; e-democracy; research methodology

Introduction

vTaiwan builds 'a consensus-building social network' that serves as a crucial lesson for Western democratic countries to learn (the BBC, 2019)

We regularly hear of social media algorithms helping to spread disinformation, or filter information to increasingly targeted audiences, or stoking political polarisation, but can algorithms also be 'consensus-building' or combat 'political disenfranchisement and

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polarisation¹? This at least is what is claimed about vTaiwan, an online platform, based on the open source platform, Pol.is (Small et al., 2021).

Social media platforms were once seen to be potentially emancipatory, a key tool for organising global social movements such as the Occupy Movement (Bennett & Segerberg, 2013; Castells, 2013; Gerbaudo, 2014). But the waning of movements like Occupy and subsequent public scandals involving social media platforms have led activists and civic hackers, many involved in the initial wave of social media driven protests, to develop alternative ‘digital democracy’ platforms based on open-source software (Small et al., 2021; Smith & Martín, 2021; Tseng, 2022). vTaiwan is one of a host of such alternative platforms² which claim to improve political participation and deliberation, something which was seen as one of social media’s unrealised potentials. Unlike corporate-run social media platforms, vTaiwan facilitates an institutionalized process for citizens and stakeholders to participate in organized online discussions around public issues. The results of vTaiwan’s participatory exercises are even incorporated into the legal revision processes undertaken by the Taiwanese government. But does vTaiwan solve the perceived problems of mainstream platforms, or address concerns about some of the shortcomings of traditional (offline) participatory techniques (Marres, 2012; Osborne & Rose, 1999; Wynne, 2011)?

Answering such questions is notoriously difficult due to the role of algorithms, embedded in these platforms, which are used to sort people into groups. Firstly, the inner workings of these algorithms are often closely-guarded company secrets, in the case of platforms developed by private companies (Driscoll & Walker, 2014; Pasquale, 2015). Secondly, the decisions these algorithms make are difficult to explain even for those who program them (Ananny & Crawford, 2018). Thirdly, even in the case of open-source platforms, where algorithmic formulae are published on Github, recursive and contingent interactions between machine learning algorithms and incoming data make it difficult to reconstruct what algorithms did and why (Amoore, 2020). Finally, it is difficult to separate what influences are to be attributed to algorithms as opposed to design features, user behaviour, or the character of particular public issues – all of which are deeply intertwined.

In this article, we argue for the use of quali-quantitative data visualizations to study how digital democracy platforms shape public issues and the public(s) which gather around them (Marres, 2007). We apply these visualizations to daily data gathered from the vTaiwan platform during a participatory exercise in 2015, concerning the legalization of Uber in Taiwan. In this exercise, the vTaiwan algorithm sorted participants into two ‘opinion groups’, roughly those who were for and those who were against Uber legislation. Through our empirical investigation, however, we find that the content of the comments, their sequence, and the patterns of voting, suggest the possibility for more nuanced positions in the debate and the potential for dialogue. We argue that vTaiwan may be limited by its focus on simple quantitative data points (votes instead of text) and its algorithmically-forced separation of participants into in-or-out groups, which may pre-empt more heterogeneous groupings or reflexive understandings of issues in democratic politics. By following the development of the issue over time, rather than just the end-result, our analysis offers an alternative account of the issue drawing out its plural, contested, and conversational dimensions.

In the first part of this paper, we review existing literature about digital democracy and the role of online platforms and algorithms in democratic politics. We then discuss the methodological challenges of studying such platforms, and the algorithms that drive them, and

propose a quali-quantitative technique to help make sense of the data. With the help of these visualizations, we attempt to unpick how the algorithm, moderators, and the content of comments contributed to the outcome. We conclude with a discussion of how digital democracy platforms, including vTaiwan, might represent publics and issues differently in the future and how quali-quantitative methods can contribute to the study of democracy online.

Literature review

2.1 Social media and politics

Following the rise, in the early 2010s of social movements largely cultivated through social media – Occupy, Los Indignados, and the so-called Movements of the Squares – several scholars suggested the potential benefits of social media for coalition-building. It was argued that online platforms allowed a lower threshold of participation in political life than traditional on-the-ground activism, enrolling people not normally involved in politics (Loader & Mercea, 2011). Bennett and Segerberg (2013) for example, argued that one advantage of social media was the rather stark aggregation of seemingly disconnected private troubles which was possible without having to agree on shared goals or messaging – ‘connective action’ as opposed to a more traditional ‘collective action’. More recently, the #metoo movement provided another example of how collating previously disconnected individual stories could gain traction as a public issue through a mass outcry on social media (though, see Trott, 2021).

Yet as Taina Bucher and others have pointed out (Beer, 2016; Bucher, 2012, 2018), social media’s focus on ‘engagement metrics’ (Trunfio & Rossi, 2021) within their sorting algorithms, draws users into a visibility game.³ This process is central to social media’s aims of delivering ‘relevant’ content – thus keeping users engaged and selling them targeted products and messages, but this visibility game may force social movements to compete for popularity with brands and sponsored content (Tufekci, 2015).

The usage of engagement metrics in social media platforms has also been thought to encourage divisive, polarizing, or misleading content (Boler & Davis, 2021; Bradshaw, 2019; Marwick & Lewis, 2017; Woolley & Howard, 2018). Gaudette et al. (2021), argue that the use of ‘upvotes’ and ‘downvotes’ on Reddit, which allow users to promote content they like and demote content they do not, helps to galvanise far-right groups. Such groups use these voting systems to promote content that they agree with and suppress uncomfortable information, without actually having to engage in dialogue. It is also argued that social media’s sorting algorithms create what Pariser has called ‘filter bubbles’ (2011). Though the concept has since been critiqued (Bruns, 2019; Dubois & Blank, 2018), the idea is that digital platforms push users into ‘bubbles’ of similar political opinions, worldviews, and knowledges – in particular, algorithmic recommendations are said to filter out diverse opinions and feed users homogenous information, exacerbating political polarisation (Tucker et al., 2018).

2.2 Digital democracy

Long before the advent of social media, there have been attempts to create e-democracy tools to harness the internet for increasing political participation. Early on in these

developments, Wright and Street (2007) broadly categorised e-democracy into two types: deliberative and representative. That is platforms either tend to collect and represent public opinion from a sample of users (representative) or attempt to facilitate the formation of public opinion through more or less managed dialogue (deliberative). It is worth noting that social media platforms such as Twitter and Facebook straddle this distinction, being more or less public (and more or less organised) forums of debate and also frequently used as a source of data for the representation of public opinion (through informal polls and counts of likes and engagement) (McGregor, 2019). As we will see, vTaiwan also problematises this distinction.

Wright (2012) critiqued the tendency of scholars of e-democracy, now more frequently referred to as digital democracy, to subscribe to one of two normative positions – platforms will either revolutionize politics or become band-aids, pretending to fix but actually preserving the status quo. Each position tends to *overwhelm* empirical studies, putting platforms into simplistic boxes, when the reality is probably somewhere in between. Rather than be drawn into a simple for or against position, we argue that researchers should examine the impacts of these platforms on democratic processes as empirical questions. In different contexts and different situations, the presence of algorithms or metrics might sway activists into a shallow counting exercise or conversely deliver novel forms of participation (or both).

This stance draws on a long line of research in Science and Technology Studies (STS) which analyses participation exercises and democratic procedures in practice (Birkbak & Papazu, 2022); Irwin & Michael, 2003; Jasanoff, 2005; Kelty, 2020; Marres, 2012; Marres & Lezaun, 2011; Wynne 2011), observing how both physical settings and discursive framings of topics tend to advantage certain actors and hinder others. Marres (2012), partially in relation to online participatory platforms, calls for a ‘device perspective’ on participation. This involves engaging in empirical study to understand how particular technologies ‘format’ participation and shape political possibilities. Who is allowed to participate in debates and discussions? What practices, count as legitimate participation?

This, however, also requires that the question of who or what matters in these situations is an empirical question as well. Lim (2020) has argued that scholars who seek to highlight the relatively unknown role of algorithms and metrics in societal interactions may inadvertently cast the algorithms in technologically deterministic ways (see Gillespie, 2013). She proposes decentring the technical and recentring the human in these interactions. For example, Bozdag (2020), through interviews with social media users, describes how, alongside sorting algorithms, a variety of human practices are involved in filtering online opinions, and thus potentially polarization.

Following the example of these studies, we remain agnostic about the relative role of these different sorts of actors in the proceedings, seeing the entire ensemble of users, political institutions, algorithmically-designed elements, and automated bots as potentially consequential actors in socio-technical devices (Law and Ruppert, 2013). Indeed, which actors are assigned responsibilities (human or platform) may emerge through the unfolding of the interaction.

A canonical case study: vTaiwan

vTaiwan is an open-source digital platform, built in collaboration between the Taiwanese government and the civic hacking community (known as ‘g0v’), for organizing an ad-hoc

institutional process of public participation on digital issues. vTaiwan involves five integrated open-source components, however, in this paper, we will focus on one component called Pol.is.

The Taiwanese government sought the prototype for vTaiwan in response to the challenges posed by the popular Sunflower Movement, which questioned the government's 'paternalistic' style of decision-making. In 2015, Minister Tsai introduced the prototype at one of g0v's hackathons, demonstrating a strong institutional commitment from the Taiwanese government to take civic opinions into account when revising legislation. Her presentation garnered great interest from the g0v community, successfully attracting numerous volunteers who helped transform the prototype into what later became the vTaiwan platform.

We consider vTaiwan to be a 'canonical' case study (see Flyvbjerg, 2006, pp. 222–223) for investigating the democratic potential of machine learning-powered platforms. vTaiwan is one of the few of the new breed of deliberative platforms to actually be integrated into Government decision-making processes. Its potential and reputation for fostering 'consensus' have been lauded by the BBC (2019), Wired (Miller, 2019), and Nesta (Simon et al., 2017) as a 'pioneering' or 'crucial' example of digital democracy.

We have chosen to focus on the debate about Uber legislation on vTaiwan, because this case is widely cited by Wired (Miller, 2019) and others (Small et al., 2021), as the most successful instance in vTaiwan, owing to its broad engagement with 1737 participants from diverse backgrounds (taxi/Uber users, drivers, and concerned citizens), who generated a total of 47,539 votes and 144 comments. Additionally, the Uber case has had considerable political and societal impact. The consensus formed from vTaiwan for the Uber case was incorporated into the legislative process, leading the Ministry of Transportation to revise several clauses in relevant regulations and acts (Tseng, 2022).

The central Pol.is component of vTaiwan, which will be our focus, works by soliciting opinions, in the form of short 'comments' from users in response to a prompt defined by the organisers of the exercise. Moderators may choose to seed the conversation with exemplary comments (Small et al., 2021) and user comments may be reworded or removed by moderators if they repeat existing ideas, are hard to follow, or represent multiple opinions, not just one. Users are shown a (semi-random) sequence of past user comments and are invited to vote (positively or negatively or pass) on each comment (Figure 1).

The creators of Pol.is recently published a paper showcasing their platform, which also uses the vTaiwan Uber exercise as a case study (Small et al., 2021). According to the paper, the algorithm ultimately broke participants down into two distinct groups which they interpret as (1) those in favour of uber and ridesharing apps more broadly and (2) those opposed to them. This is demonstrated in the paper by showing a graph of the participants (circles) arranged in two-dimensional space so that participants with similar voting patterns are depicted as closer to each other (Figure 2). Interestingly, the graph does not show two obviously distinct clusters, as in the public visualization above but one large spectrum with two poles. The colour coding then shows the algorithm attempting to detect distinct clusters within this spectrum.

The paper claims that Pol.is combines quantitative and qualitative methods, though they do not go into much detail about the later. They do however give the example of focus groups as a qualitative method which their technique might supersede. However, many qualitative researchers would argue that focus groups are about more than

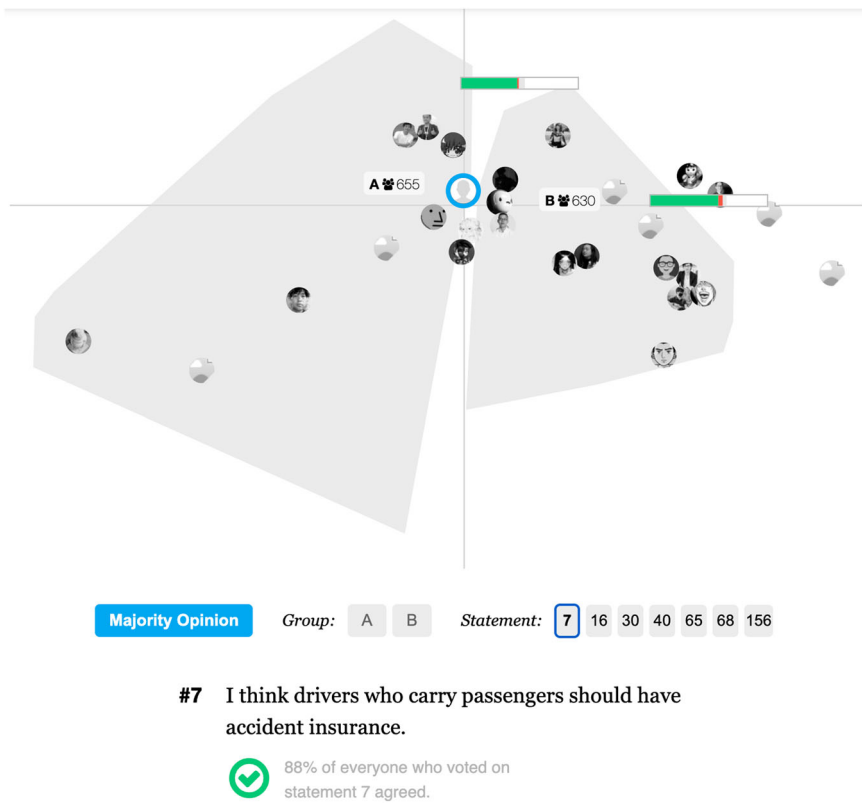


Figure 1. The Pol.is / vTaiwan interface with a visualisation of users (circles with pictures) plotted on a two dimensional space, separated into two opinion groups (represented by the two grey polygons). Below the interface displays opinions and which groups vote positively on them. In this case, the statement depicted is a ‘common opinion’ also known as ‘consensus statement’. Image from Pol.is’ promotional material.

instrumentally extracting opinions. Analysing a focus group would involve not only the content of what was said but also the larger situation in which information is being extracted (Kitzinger, 1994), including the power dynamics in the room (who feels empowered to speak) or the evolving relationship (e.g., rapport) between the moderator and subjects. One might see the former understanding as a psychological use of focus groups, whereas the second is a sociological one.

What happens if we add this more sociological version of qualitative methods into the equation? And what happens if we use quantitative techniques, not to make definitive claims about public opinion, but rather to make sense of how public opinion is formed between user and algorithm – to look at the exercise ‘in action’ (Latour, 1987) rather than as an end result.

Quali-quantitative methods

Over the past 20 years, scholars from STS, media studies, and sociology have found innovative ways of repurposing digital traces from the internet for the purpose of social

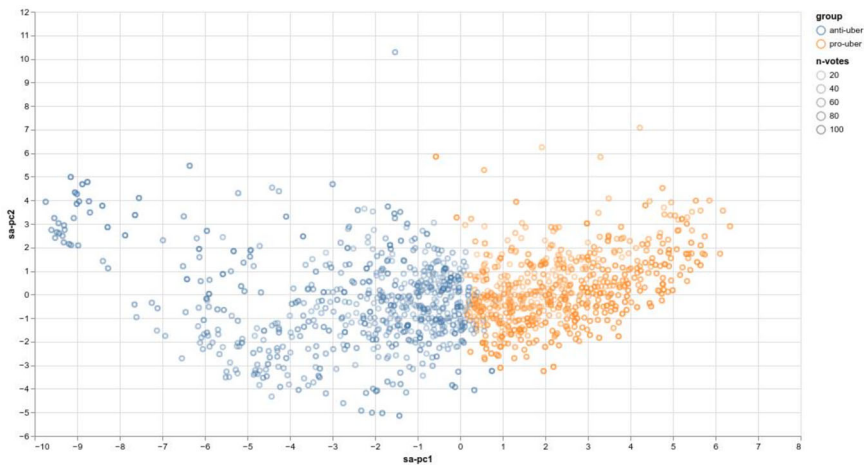


Figure 2. Analysis of opinion groups from uber case by Small et al. (2021). Original figure caption reads: ‘Participants are plotted according to the sparsity-aware corrected PCA projection, colored by K-means assigned opinion group. Participants with fewer votes are less opaque.’

research, often through data visualizations. Although they employ the same data (and often similar methods Marres & Gerlitz, 2015) as major social media companies, they do not use the data to know more about users preferences and desires but to interrogate the role of online platforms, algorithms, or data points (hyperlinks, likes) in shaping sociality. Rogers (2009) and colleagues, for example, scraped Google results for certain controversial queries like ‘9/11’ and visualized the results. They noticed how the rankings changed over time as both the Google search algorithm and the landscape of websites changed. Deville and van der Velden (2015) used a kind of reverse engineering – entering different inputs and receiving outputs – to understand how a predatory lending website’s algorithm delivered different offers and interest rates depending on which browser was used and which user data was supplied. Such techniques cannot tell us definitively how an algorithm works, but they can prompt questions about why certain changes took place or why certain individuals are treated differently. These questions can be followed up on through qualitative investigations, which may inform the development of further quantitative approaches, resulting in what Venturini and Latour have called quali-quantitative methods (2010).

However, there is a danger, in relying on the platform data (in either qualitative or quantitative research), that such analyses end up ‘buying into the logic’ of a platform, accepting its definition of what is important or relevant (Moats, 2019). In order to sort through massive amounts of data, researchers are often forced to limit their analysis to only the most popular (most mentioned, most connected, or most active accounts or content). It is easy, then, to take for granted that this ‘popular’ content is the centre of the phenomenon being studied instead of actively searching for users or content which are not represented well by platform logics.

However, it can be equally problematic to attempt to sidestep these logics. Madsen and Munk (2019) highlight this problem, recounting how they facilitated an in-person participation event pertaining to the future of the school system in Denmark with digital

methods techniques. A discussion had already started on the municipality's Facebook page, so they designed a process by which in-person attendees of the event would contribute to the Facebook page and the results would be visualized, which would then prompt more discussion and contributions. They encouraged participants to put #hashtags naming important dimensions of the debate in their posts so that they could represent the debate as a network of hashtags which appeared together (co-occurred) in posts. Their normative goals were to map the heterogeneity of debates and minimise assumptions as well as to resist dominant platform logics.

'For instance, when faced with frequency-based logics such as Facebook's priority of the most "liked" content, practitioners of digital methods need to remediate the digital traces of the platform'. (p. 5)

Yet by using so called 'relational measures', they ironically ended up side-lining one of the most important groups in the process – the unionized teachers, who protested the consultation by 'bombing' the Facebook page with negative messages questioning the authority of the process. By not engaging with the hashtag generating activity, their views became just another concern of many, drowned out by mostly mundane or myopic requests for improved local services in the network (see [Figure 3](#)).

This is a striking example of the politics involved in how publics are represented through various metrics and visualization techniques (Kennedy & Moss, 2015) and how things may play out differently with particular publics and issues. How can these popularity metrics and algorithmic effects be kept in view without them overdetermining the analysis?

3.1 Data

The present study is based on data from vTaiwan's month-long online participation about Uber legalization in vTaiwan. The data consists of daily tabulations of comments, how many votes each comment received, the different groups participants were placed in by the algorithm and separate daily tables of participants and each vote that they cast. This database was collected with the help of a data scientist from Pol.is Inc during the ethnographic fieldwork for one author's PhD dissertation (Tseng, 2020) which was a comparative study of digital democracy platforms in Taiwan and Spain. The data scientist recomputed how the machine learning algorithms divided the participants into groups across the 30 daily time slices of the month-long participatory process. This data collection conforms to GDPR and does not contain any personal information (such as IP address), users were anonymised in the dataset as participant 0,1,2 etc.

Given this time based data, we considered various options which would have visualized different time slices in the same graph (e.g., Marres & Moats, 2015; Moats, 2016) including a simple matrix of users (y axis) and the opinion groups they were placed in each day (x axis). But most of these options involved accepting the algorithmic opinion groups rather than interrogating their boundaries. In the end, we decided to visualize this data using a sequence of bi-partite network graphs, using network visualization software Gephi (Bastian et al., 2009).

Network graphs are one common way to display clusters of entities without reducing them to in-or-out groupings. Networks usually consist of circles (nodes) connected by lines (edges) and can be spatialised (laid out on a page) using gravity-based algorithms

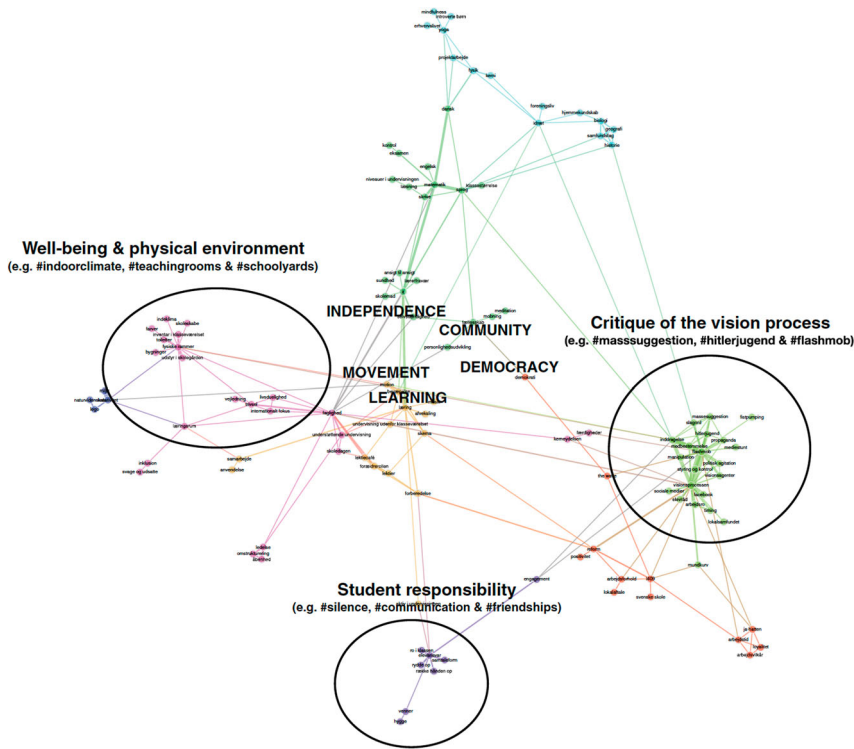


Figure 3. Munk and Madsen's map of Facebook hashtags – Madsen and Munk (2019). Original figure caption: 'Network visualisation providing a thematic overview of the Facebook debate. Nodes represent hashtags and two hashtags are close to each other if they are often used in the same post. Nodes with the same color indicates a mathematical cluster that can be interpreted as a theme.' The group of nodes to the right labelled 'critique of the vision process' are hashags found in posts which received a comparatively high proportion of comments as likes, but because only hashtags and their co-occurrence are represented, this cluster appears no different from other hashtag clusters.

like Force Atlas2 (Jacomy et al., 2014) such that nodes with more connections are drawn together into more-or-less dense clusters. Standard networks, however, only visualise relationships between one type of entity. Bi-partite networks are networks with two different types of nodes instead of one.⁴ These graphs have been used in situations where it is useful to interrogate relationships between two types of things, for disease modelling, bibliometrics and cryptography and more recently in the study of social network analysis (Marres & Moats, 2015; Moats, 2021; Munk et al., 2019).⁵ In the figure below, we could make a standard network of, in the case at hand, users connected when they vote positively on the same comment, depicted as nodes (circles) connected by edges (lines). But in doing so, we are technically abstracting away the comments which make up the relationship between users. Instead, we could make a bipartite network which includes the comments themselves as a different type of node, connected to participants who vote positively on them (Figure 4).

Now, it is important to note that this is a slight reduction of the data because Pol.is' method also considers who votes *negatively* on a post. But due to the conventions of networks, there is no such thing as a non or negative connection. However, in future studies,

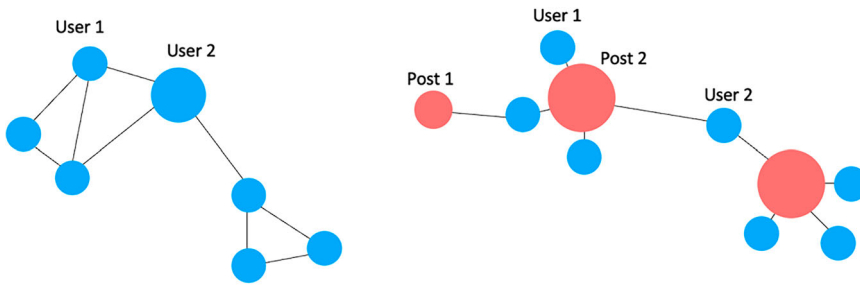


Figure 4. Our illustration of standard network with one type of node (left) and bipartite network with two (right). In the standard network, users are connected with each other when they interact with the same post and in the bipartite network, the posts are displayed as well.

the spatial layout of the network, which draws together nodes by their connections, could factor in some kind of repulsion to nodes with negative votes. So, if our map shows less obvious polarization, it may be because this polarization detected by machine learning algorithms arises more from the *negative* votes than the *positive* ones.

These bi-partite networks, which we plotted at different points in the process, allowed us to more concretely examine the relationship between users and comments over time as well as important meta-data stored about both, such as the proportion of negative and positive votes given by each user.⁶ We coloured the participant nodes according to what opinion group the algorithm has placed them in at a given time and we sized the participant nodes by the number of comments they voted on and the comment nodes by how many votes they received.⁷

These visualizations served as an aide to our qualitative analysis of the discussion. They helped highlight certain comments which received a disproportionate amount of attention at a given time from certain sorts of users, or participants whose votes were distributed unevenly. These visual points of interest could be followed up on by consulting the data itself. We analysed the content of the comments qualitatively, while taking into account how many votes they received or where the algorithm placed participants who voted on them. The visualization also allowed us to link these individual comments and participants with patterns at the aggregate and the opinion groups selected by the algorithm. Ultimately, through this process, we developed a different understanding of the public issue beyond the binary for or against positions identified by the algorithm.

We should note, however, that this visualization does not pretend to offer a more ‘true’ arrangement of the emergent public into groups, than either the platform’s visualization or the scatterplot from the Pol.is paper (Figure 3), only a different one. This is because there is no natural or self-evident relationship between a set of data and a visual representation of it, though each may have advantages and disadvantages (Kennedy & Moss, 2015). Our purpose in using this alternative visualization is to raise questions about the exercise of placing participants into groups in the first place. The bi-partite network allows us to do this by contrasting a gravity-based clustering of nodes (represented spatially) with the clustering defined by the Pol.is algorithm (represented by colour) – prompting questions about the differences between them. But mainly, we should stress, the utility of the network comes from quickly zooming between these aggregate patterns and individual data points.

Analysis

In this section, we give an account of the participation experiment over time, both based on the maps we created and qualitative analysis of the text of the comments. At the beginning of the exercise, the organisers provided the following prompt for users (along with instructions and links to background reading):

‘does UberX, which provides different choices and experiences, need to abide by the same laws as taxi companies or other car rental services?’

There are a couple things which are interesting about this prompt. Firstly, it ends in a question which could, but does not need to be, answered as ‘yes’ or ‘no’. This simple fact may already make it likely that the discussion will result in two opposing groups because the question frames the situation as having two possible courses of action.⁸ The question could have asked ‘how should uber be regulated, if at all?’ – though this might be harder to directly translate into a policy recommendation. Secondly, to allow machine learning algorithms to clearly identify each user’s position in the discussion, users were asked not to respond to other comments directly nor to include multiple opinions in single statement. The former seems essential for deliberative models of democracy – that positions might be clarified, modulated or in-general, changed – but the Pol.is algorithm requires that comments each represent a stand-alone opinion independent of other opinions.⁹

In the days leading up to the first official day of consultation, a moderator set the scene by inputting comments related to participant’s identity like ‘I am a Taxi driver’, ‘I am an Uber driver’, ‘I have used Uber service’. Presumably users were meant to vote on these statements if these identities represented them and these identities would become the starting opinion groups. The moderator also introduced a variety of sample opinions (possibly devised by the organisers or gathered from previous discussions) which do not respond directly to the binary prompt but rather propose nuanced positions on sub-issues such as ‘the price of Uber’, Uber’s tax liability, right for taxi and Uber drivers to work for different companies, ‘insurance for Uber drivers’, etc. (see the [Appendix](#) for a full list of the comments) ([Table 1](#)).

4.1 July 15 2015

In [Figure 5](#), the grey nodes represent comments, labelled with the number of the comment, coloured nodes represent users, labelled by their user number. Lines connecting users to comments represent a positive vote on that comment, lines are coloured based on the opinion group of the user. Note that the most popular comments (and most active users) are larger and generally brought to the center of this graph, with less popular comments (1,2 and 11) appearing much smaller and on the outskirts. On the first day of official voting (15th), vTaiwan’s algorithms categorised public opinion on Uber into four ‘opinion groups’, represented by the four colours assigned to the user nodes. It is unclear at this point what characterises the different groups. Group 0 (pink) voters seem to like comments calling for various regulations on Uber but group 1, 2, and 3 (blue, green, and yellow) are not exactly anti-regulation ([Table 2](#)).

Table 1. The first few comments were created by the moderator (user 0).

Comment number	Comment text	Timestamp
0	I have used Uber app/service	Tue_Jun_30_01:49:52_PDT_2015
1	I am a Taxi driver	Tue_Jun_30_01:50:17_PDT_2015
2	I am a Uber driver	Tue_Jun_30_01:50:33_PDT_2015
3	I think Uber can increase the price of its service during the peak time	Tue_Jun_30_01:51:36_PDT_2015
4	I think taxi and Uber drivers should be able to work for different taxi companies	Tue_Jun_30_01:53:42_PDT_2015
5	I think it is the Ministry of Transportations responsibility to actively crack down unlicensed taxi	Tue_Jun_30_01:54:09_PDT_2015
6	I think Uber cars should be clearly signified	Tue_Jun_30_01:54:37_PDT_2015
7	I think Uber drivers should be covered by insurance	Tue_Jun_30_01:55:36_PDT_2015
8	I think Uber company should pay tax to the government in the locality where it operates	Tue_Jun_30_01:56:17_PDT_2015
9	I think Uber company should report any quarrel settlements to the Ministry of Transportation	Tue_Jun_30_01:58:08_PDT_2015

Comment 12, in the upper right of the graph, reframes the regulation issue by proposing that Uber should be considered an IT company, rather than a taxi company, and thus subject to existing IT regulation – a status which likely places less of a legal burden on Uber. This comment ultimately received many positive votes, mostly from group 2 as one can see from the green lines emanating from it. Interestingly, the moderator created a comment (17, which can be seen in the bottom of the graph) soon after expressing the *opposite* view – that Uber is part of the service industry. This received positive votes from all three groups equally, at least during the first day. As the exercise progressed however, one should note that the composition of these groups in terms of which users are included, and thus possible interpretations of their character, will change over time.

4.2 July 16 2015

In the second day of voting, the algorithm reduced participants to three opinion groups. We can see the group 0 (pink) categorized users and comments popular with them starting to amass together in the lower half of the graph, but users categorized in groups 1 and 2 have less distinct areas, according to the spatialisation algorithm at least. Comments collecting positive votes from group 0 (pink) still seem to be calling for regulation but comments favoured by the other two groups remain more ambiguous. They call for changes (such as requiring Uber drivers to be insured – comment 32) but do not necessarily involve Uber being shut down or sanctioned. The moderator's starting comments, also more ambiguous, are also popular with groups 1 and 2 as we can see from the voting lines (Figure 6; Table 3).

Another genre of comment which emerges does not attack Uber directly but rather challenges the government to be consistent in its decision-making. User comments 25–28 and 30 follow a similar line of argumentation: that Uber breached several existing transportation regulations and hold the Ministry of Transportation (and associated authorities) accountable for not taking legal action to suspend Uber. These name and shame the Taiwanese government for 'not doing its job properly'. Comments 25–28 were deleted by the moderator, possibly for being too long, and thus received negligible votes. Comment 30 (probably introduced by the moderator as a less wordy version of

4.1 July 15 2015

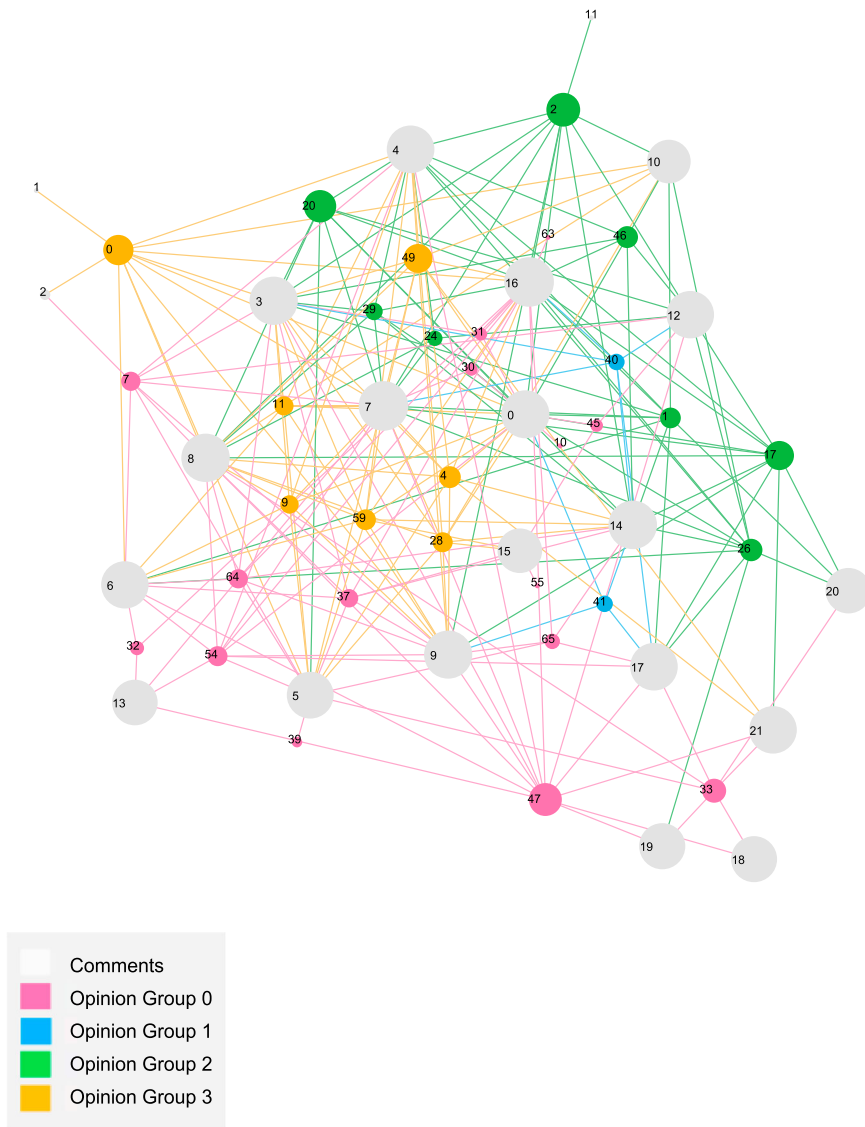


Figure 5. Bi-Partite participant-comment network on 15-07-2015. Grey nodes represent comments and other nodes are participants who voted positively for them, coloured by opinion group as determined by the algorithm. Nodes are sized by votes given or votes received. The graph is spatialized by Force-Atlas 2 gravity based algorithm.

the previous comments) was seen positively by group 0 on day two but by the end had received the most negative votes of any comment in the exercise (something which is not visible in the graph). Interestingly, the comment questioned the necessity of a public consultation at all, considering this matter to be the responsibility of the government: Uber's existence contravenes current laws, so what is there to discuss?

Table 2. The first few (mostly) user generated comments.

Comment number	Comment text	Timestamp
10	I have used Uber service outside of Taiwan	Tue_Jun_30_02:27:46_PDT_2015
11	I would like to tell you a secret	Tue_Jun_30_02:28:44_PDT_2015
12	Uber companay is a matchmaker type of platform just like other ecommerce platforms. It is considered as IT industry.	Tue_Jun_30_05:36:59_PDT_2015
13	I think Taxi should be painted yellow the legal colour for Taxi in Taiwan in order to differentiate itself from other cars	Tue_Jun_30_22:54:39_PDT_2015
14	I have a driving licence	Thu_Jul_02_18:05:05_PDT_2015
15	I have an occupational driving license	Thu_Jul_02_18:05:19_PDT_2015
16	Uber cars should take out insurance for their passengers'	Thu_Jul_02_22:20:24_PDT_2015
17	Uber company is part of the service industry because it employs drivers to offer its service	Sun_Jul_05_02:13:27_PDT_2015
18	Uber is a risky service because it does not operate as a legal business	Wed_Jul_15_05:57:00_PDT_2015
19	I have doubts about Uber service because its managment system is not transparent	Wed_Jul_15_05:57:11_PDT_2015
20	I think Uber company has created an unfair competition in domestic transportation industry.	Wed_Jul_15_05:57:14_PDT_2015
21	According to the regulation Uber should be made to register as a transportation business [rather than as a software business]	Wed_Jul_15_05:57:18_PDT_2015

These comments, by deflecting responsibility elsewhere and stressing existing legal frameworks, attempt to shut down debate. We might call these, following Barry (2002 in reference to the work of Mouffe, 2005), ‘anti-political’, that is closing down the space of disagreement. It just so happens that this position, not questioning the status-quo of existing regulation, implicitly presumes that Uber is a taxi company – a matter which in other comments remains contested.

As we’ve already seen, throughout the first few days, the moderator frequently deleted and rephrased comments from users that might have seemed unclear or which were too long or expressed multiple opinions. For example, comment 23 seems to have been rewritten as comment 24 by clarifying that it referred to Uber, not other taxi companies. This was likely done to increase the chances of the votes making sense: confused voting on ambiguous comments would presumably make it harder for the algorithm to place participants into groups.

4.3 July 17 2015

Already by day three, the algorithm had reduced the number of clusters to only two, with more participants seemingly in favour of regulating (or suspending) Uber (group 0, pink). Until this point, the other groups, now presumably consolidated into group 1, seemed to favour less stringent reforms. But on day three, comments began to emerge, favoured by group 1 (blue), which positioned Uber as ‘better quality’ than a taxi (38, 39). These comments seemed to strengthen the impression that the groups were simply ‘pro-Uber’ and ‘anti-Uber’ as the Pol.is paper (Small et al., 2021, p. 12) characterizes them and yet, looking at the graph, many comments received positive votes from users in both opinion groups (Table 4).

Similarly, many comments, which were, at one point, algorithmically put into the ‘anti-Uber’ group, actually pointed to a broader problem in the dispute over Uber’s (il)legal status. The problem at stake here is not just about how Uber as a company breaches

4.2 July 16 2015

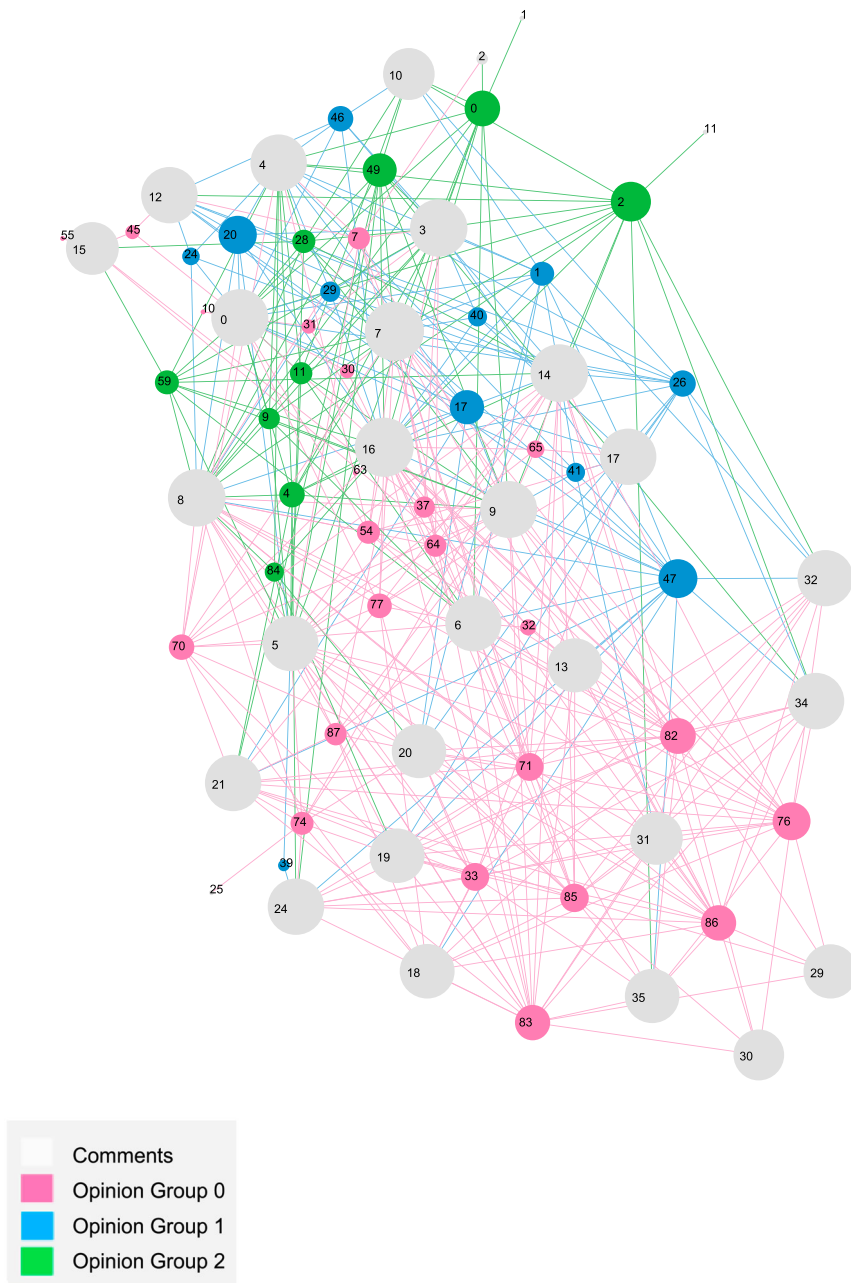


Figure 6. Bi-Partite participant-comment network on 16-07-2015. Grey nodes are comments and other nodes are participants who voted positively for them, coloured by opinion group as determined by the algorithm. Nodes are sized by votes given or votes received. The graph is spatialized by Force-Atlas 2 gravity based algorithm.

Table 3. Comments from the second day of voting.

Comment number	Comment text	Timestamp
22	I think every Uber driver should take insurance for its passengers	Thu_Jul_16_18:44:06_PDT_2015
23	I think the government should take control over the individual profile of all drivers	Thu_Jul_16_18:44:34_PDT_2015
24	I think the government should take control over the individual profile of all Uber drivers	Thu_Jul_16_19:08:33_PDT_2015
25	The Ministry of Transportation has already ordered Uber company to suspend its business. Why does the ministry of transportation still allow Uber to continue its operation? I would regard the government as incapable if it cannot follow the regulation and crack down the illegal business Uber company	Thu_Jul_16_20:22:05_PDT_2015
26	Uber company is ordered by the government to suspend its business. How can it still operate in Taiwan? Allowing the Uber service to exist shows how incapable this government is how untrustworthy this government is. I am very worried about the situation when it is citizens who have to take actions against the illegal business	Thu_Jul_16_20:40:26_PDT_2015
27	I think the Uber company has breached the associated regulation because it provides Taxi service as a registered IT company instead of as a transportation company. In addition Uber drivers do not have to pass the qualification exam to become a Taxi driver. Who will take the responsibility if there is an accident? Is it the government? The government should take Uber's business licence away.	Thu_Jul_16_20:42:08_PDT_2015
28	No insurance no protection	Thu_Jul_16_20:44:16_PDT_2015
29	I think the Ministry of Transportation has poorly controlled illegal business like Uber which indicates its incapability	Thu_Jul_16_20:52:54_PDT_2015
30	I think the government should endeavour to suspend Uber's business. Citizens do not have to express their opinions on this matter.	Thu_Jul_16_20:53:54_PDT_2015
31	I think Taipei City Hall should annul Uber's company licence as Taiwan Uber Digital given the fact that the Ministry of Transportation has turned down Uber's appeal.	Thu_Jul_16_21:01:25_PDT_2015
32	I don't feel safe if Uber company does not take out insurance for passengers.	Thu_Jul_16_21:02:20_PDT_2015
33	I think Uber service should not exist. Its service charge is not reasonable. It also badly manages cars and drivers. Drivers are not trained professionally.	Thu_Jul_16_21:04:25_PDT_2015
34	I think Uber drivers should obtain an occupational driving licence.	Thu_Jul_16_21:09:02_PDT_2015
35	I think Uber company does not strictly examine the quality of Uber drivers.	Thu_Jul_16_21:10:32_PDT_2015

certain regulations. Rather, it is about how Uber poses a threat towards Taxi drivers in ways which reveal long-standing issues within the Taxi industry such as its old-fashioned management, low-quality (or unstable) service and oversupply. Comment 49 was given as an example in the Pol.is paper, of a 'consensual' statement, in that both those that thought Uber should be regulated and those that did not agreed that neither Uber drivers or taxi drivers should be disadvantaged (Figure 7; Table 5).

These comments are not necessarily blaming Uber, they are about the wider call to adapt existing Taiwanese legislation to accommodate new models of digital service and sharing economy without compromising the rights and livelihood of those who are at the margin of platformisation. There are other types of comments which do not so neatly fall into for or against positions. For example, many users suggest modifications to the Uber platform – suggesting different problems that it could solve: one user, for example suggested that Uber could be good for carpooling.

Table 4. Comments from the third day of voting.

Comment number	Comment text	Timestamp
36	How can Uber company make money in Taiwan but not pay tax to the Taiwanese government? Which stance does the government take in this matter? Does the government suggest citizens can also conduct illegal activities? Illegal activities should be cracked down! Uber drivers do not pass the same qualification exam as taxi drivers are their cars legally registered? Do they take insurance? It is obvious that what they are doing is illegal in particular hidden behind the name of digital technology. The government lost trust from citizens by not taking action against Uber.	Fri_Jul_17_02:47:19_PDT_2015
37	I think governmental institutions from different levels should express their opinions about the Uber issue before the consultation process starts.	Fri_Jul_17_03:29:04_PDT_2015
38	Uber is preferable to a conventional taxi if I am not in a rush	Fri_Jul_17_09:09:10_PDT_2015
39	Uber is of better quality than a taxi	Fri_Jul_17_09:09:37_PDT_2015

Table 5. Selected comments.

Comment number	Comment text	Timestamp
49	In Taipei metropolitan area Taxi drivers are subject to a fierce competition against various modes of public transportation metro bus ubike etc. Allowing Uber company to provide its service would make Taxi drivers life more difficult. Please think twice!	Mon_Jul_20_18:28:52_PDT_2015
50	Allowing Uber company to offer its service would only make taxi drivers difficult to survive	Mon_Jul_20_18:34:03_PDT_2015

However, at this point the conversation seemed to diverge from the central issue of regulation and become a forum on Uber's worth as a company. A wave of comments supportive of Uber (59, 61, 69, 72) were then followed by comments which were critical of Uber (79 which was rephrased as 80). These comments, like others at this stage, seemed to be explicitly in response to some of the previous positive comments about Uber's low price. This was followed by further positive comments about Uber's benefits (91, 92) and Taiwan's need to join the platform economy (108, 112, 123) (Table 6).

Does this alternation suggest that users see one side is 'winning' in the vTaiwan interface and feel the need to balance things? Is the seeming devolution of the debate into more straightforward for/ or against positions a result of the algorithmic sorting of the public into binary groups? Or are these groupings a reflection of this polarisation already brewing in the voting patterns? It is impossible to know for sure, but the visualizations help us to see that the binary split by the algorithm seems to slightly precede this shift in the character of the comments.

4.4 August 14th

At the end of the exercise, the participants remained firmly sorted into two groups, which according to the Pol.is paper correspond to 'pro-Uber' (blue) and 'anti-Uber' (pink) positions, though at this point there appear to be more participants in the pro-Uber group. However, we can see from the graph above that many users assigned to these groups vote positively on comments which have been spatially drawn closer to the other side. Much

4.3 July 17 2015

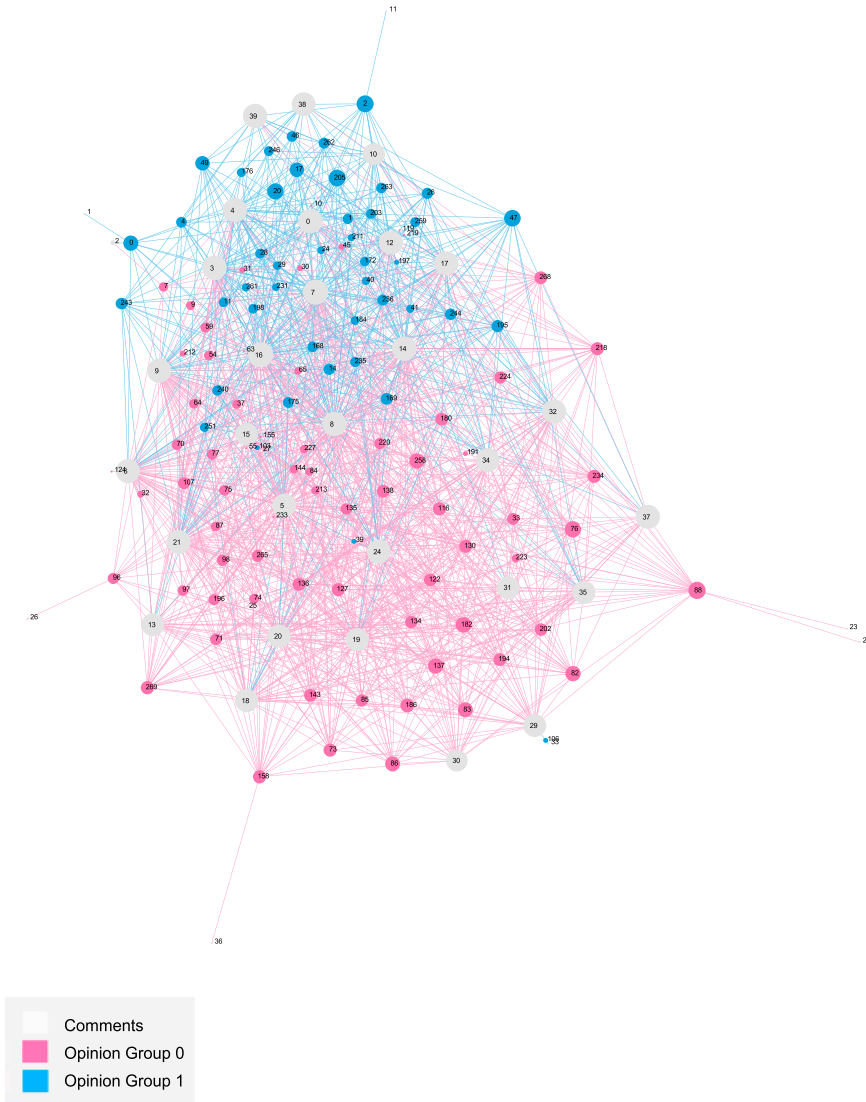


Figure 7. Bi-Partite participant-comment network on 17-07-2015. Grey nodes are comments and other nodes are participants who voted positively for them, coloured by opinion group as determined by the algorithm. Nodes are sized by votes given or votes received. The graph is spatialized by Force-Atlas 2 gravity based algorithm.

like in the scatterplot made by Pol.is, but perhaps even more clearly, the boundary between the groups is not binary but amorphous and fuzzy with intricate connections (Figure 8).

If we focus on the pink lines, representing positive votes on ‘anti-Uber’ comments, emerging in the ‘pro-Uber’ (blue) user cluster, it is clear to see that many ‘anti-Uber’ group users are not actually against everything about Uber. So called ‘anti-Uber’ users often actually enjoy Uber’s cheap, innovative service as customers, and approve Uber’s

Table 6. Selected comments.

Comment number	Comment text	Timestamp
59	I think using the Uber APP can prevent drivers from taking a detour	Tue_Jul_21_03:57:49_PDT_2015
60	I think that many taxi drivers have a bad driving behaviour	Tue_Jul_21_04:06:21_PDT_2015
61	I think sharing economy can reduce waste of social resources	Tue_Jul_21_04:07:30_PDT_2015
72	Uber service is cheaper than Taxi. On average the cost that I've saved by taking Uber amounts to a meal	Wed_Jul_22_05:40:38_PDT_2015
79	Uber's logic of fee calculation does not make sense to me. It does not calculate the fee based on the realtime situation of demand and supply but based on specific time classification. It seems strange to me that sometimes the price for Uber black is cheaper than the price for Uber X.	Wed_Jul_22_09:56:27_PDT_2015
80	The logic through which Uber calculates its fee appears opaque to me. Sometimes it is cheaper to take Uber Black than Uber X.	Wed_Jul_22_09:59:02_PDT_2015
81	I think it is fine but it would be better if it is open to the public	Wed_Jul_22_10:09:51_PDT_2015
91	I think Uber provides the public with a convenient mode of transportation. Uber also has a mechanism to ensure passengers' rights.	Wed_Jul_22_21:31:39_PDT_2015
92	Considering that Uber has already established a mechanism to ensure passengers' rights it can really benefit the public if Uber is allowed to operate in Taiwan.	Wed_Jul_22_21:39:18_PDT_2015
108	I think Uber is a platform which signifies a global phenomenon for e-commerce platform. Taiwan needs to be part of this.	Sat_Jul_25_01:40:50_PDT_2015
112	I think the government should adapt its regulations to the new digital service. It should not impose the old regulations on the new digital service.	Sun_Jul_26_20:46:15_PDT_2015
123	Regarding the question whether we need a new regulation or revise the current regulation for Uber I think it depends on how much influence Uber has. In my view Uber does not have a great impact on our everyday life. I will agree to revise or establish new regulation if the public thinks Uber indeed possess a significant influence over their life.	Tue_Jul_28_23:40:19_PDT_2015

flexible employment from the drivers' viewpoint. 'Anti-Uber' users also may allow for the possibility that Taiwanese government will give Uber a chance to adapt its business to fit the legal situation in Taiwan. Considering all of this, it might be more accurate to say the cluster is simply anti-legalization of Uber in its present form; 'anti-Uber' does not adequately capture the complexity and diversity of opinions within this user group.

In a similar vein, users from vTaiwan's pro-Uber group do not always completely agree with Uber's mode of operation. We can see the blue lines (suggesting users' positive votes) have reached right into the territory of the so called 'anti-Uber' cluster. This indicates that some users from the so called 'pro-Uber' group share the same concerns as 'anti-Uber' users. 'Pro-Uber' users agree that it is important for Uber to cover necessary insurance for drivers and passengers and that it is important for the Taiwanese government to make sure that Uber conforms to local regulations like Taxi companies.

4.5 Discussion

In this section we consider the roles the different actors (moderators, comments, votes, algorithms) played in the proceedings. How, in short, did vTaiwan format the issue of Uber legislation and the public(s) who are concerned with it?

4.4 August 14th

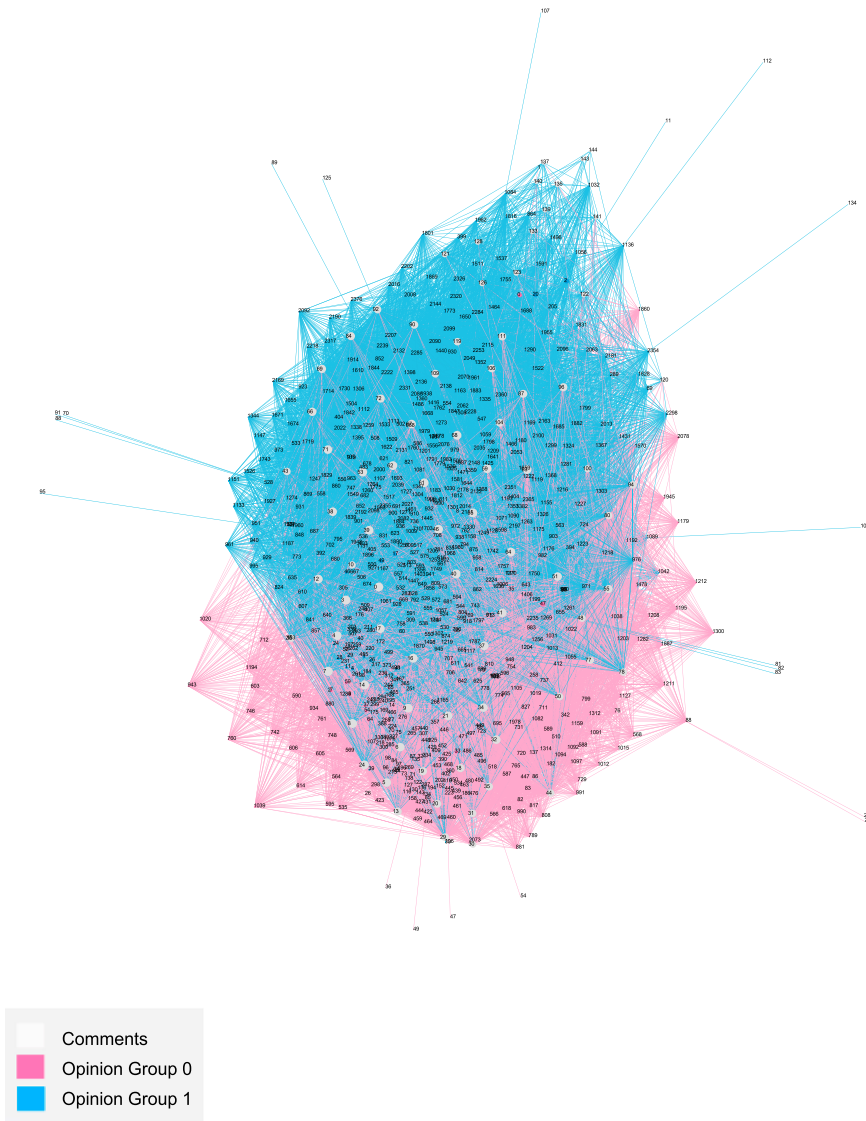


Figure 8. Bi-Partite participant-comment network on 14-08-2015. Grey nodes are comments and other nodes are participants who voted positively for them, coloured by opinion group as determined by the algorithm. Nodes are sized by votes given or votes received. The graph is spatialized by Force-Atlas 2 gravity based algorithm.

Firstly, we found that human moderation plays a significant role in shaping the discussion. As we noted, the prompt, while relatively clear, is presented as an either/or issue. This may be the case because the policy makers had a binary choice to make – but this does not seem to contain the many possibilities open to them. Also, we can see that a significant proportion of comments were ‘moderated’, as in removed from the corpus of comments, or rephrased. This involves difficult judgements about what

is important about a comment, what a particular user ‘meant’ or what counts as an ‘opinion’. It may be the case that the goal was to ensure diversity and non-repetition of opinions represented but this is itself a consequential choice which shapes the exercise.

Secondly, it was also clear from reading the comments that some of them, judging by the sequence in which they emerged, probably originated as responses to other comments. They also often appeared in waves of similar comments. So despite the fact that the platform discourages comments whose meaning is dependant on other comments, there is evidence that some form of call and response dialogue is at play here. We should also note that one potentially significant function of comments is not so much offering an opinion on the issue as reframing the discussion, stating differently what the discussion is about even if, by doing so, they could be seen to benefit a certain position.

Thirdly, given the variable possible interpretations of what a comment does (other than just representing opinion), it is also not self-evident what a vote means in these exercises. Does voting mean that a user holds or does not hold a particular opinion? Or does it signify that a particular comment is pertinent to the discussion or not, regardless of whether or not the user agrees (as is sometimes the case with Reddit votes). The algorithm does not require these meanings to be settled in order to cluster participants, but such questions are crucial in attempting to interpret the results.

Finally, our visualizations along with our qualitative investigation, raises questions about how justified the two group division by the algorithm was, given the spectrum of opinions. Regardless of the utility of the K-Means clustering algorithm for detecting groups, the *presentation* of opinion groups to users as distinct rather than as a spectrum may have, we suspect, concretized these groupings. The paradox is that the (algorithmically defined) distinct opinion groups are needed to determine what statements are ‘consensus building’ and encourage them, yet the *display* of such groups as distinct, might also increase polarization.

One of the key advantages of network graphs is that they need not be sorted into discreet groupings – clusters can be more or less dense or connected in different ways. An advantage of bi-partite networks in particular is that they visually depict the concrete actions (users voting on comments) which would normally be abstracted into a network with one type of node or, indeed in a scatterplot, making the overall patterns more easily traceable. Yet by integrating the algorithmic groupings in to our graph in the form of colour, we were able to interrogate these groupings by contrasting them with the network’s spatialization.

Now, we are not recommending that our bi-partite network should be used in place of the Pol.is visualizations because as the Pol.is authors rightly note, users may have different levels of familiarity with visualizations.¹⁰ Yet while bipartite networks may be too technical for most viewers to understand, they also have the advantage of showing user groupings as resulting from user practices (voting) rather than as abstract identities ascribed to them. Having access to such a graph during the exercise might facilitate ‘gaming’ the algorithm, by allowing users to see more clearly the effects of their voting. There is some indication that advanced users *already* know how to rework the algorithm to their own advantage (Tseng, 2022).

Instead, what if the algorithm was designed to pro-actively locate emergent groups between clusters with a lower threshold for cluster detection – such that, for example,

the desired number of groups is always three or more (even if the trend of the discussion is towards polarization)? The authors of the Pol.is paper suggest that the platform's strength is to only consider votes, making it language independent. Yet we think something may be lost by disregarding language because it side-lines, in some ways, the very important dialogic dimensions, captured above, which aim to articulate what the matter is about in the first place. What is at stake here? Is this about regulation or safety or fairness? These discussions about what matters or what the issue is about, happen on a different register than the discussion about regulation or not. The Pol.is authors suggest that a future feature might be to allow users to click a button to say that a particular comment is 'important to them' (Small et al., 2021). This would be an attempt to separate off the two functions of voting – 'I agree' from 'this is relevant'. We agree that this would be a helpful addition but also encourage the developers to include something of the content of discussions (not just votes) in the algorithmic analysis.

Conclusion

We began this paper by considering various claims about the role of algorithms and digital platforms in democratic processes, both optimistic and pessimistic. We noted that many analyses of platforms for digital democracy tend to focus either on the role of algorithms or the role of humans, but not both. We also noted that it was difficult, however, to analyse the relationship between different actors in the proceedings when they are so closely intertwined. This is partly because the data from these platforms, when it is made available at all, is often presented as only an end-result, not over time.

In response to these challenges, we proposed a quali-quantitative technique, bi-partite networks, which allowed us to qualitatively analyse the evolving discussion while keeping in view patterns at the so called 'macro' level (Venturini & Latour, 2009): the way votes were distributed and the way the algorithm generated groupings over time. While this technique cannot tell us anything *definitive* about the relative impacts of users, moderators and algorithms on the results, it helps to raise questions and highlight possible relationships to follow up on. This analysis was only possible, because we were given access to granular data over time, something which is not always made available, even in open source platforms. We encourage digital democracy platforms to make this data available when possible so that both researchers (and participants) can interrogate not only the results *but the process*. The potential though, if more granular time data was made available for different Pol.is consultations (or indeed for similar digital democracy platforms) such graphs, or something similar, could be used for comparative purposes to evaluate the influence of the algorithm in different situations.

Our analysis suggested that the algorithm's bifurcation of the participants by their voting patterns might not have been warranted with respect to the wide-ranging content of the comments and may even have encouraged the *entrenchment* of these positions as much as it encouraged attempts to bridge them. We argue that the platform's focus on quantitative data points (votes) at the expense of texts and the inclination to display distinct groups (and perhaps fewer groups) may have the effect of dampening a more lively and nuanced conversation and a more pluralistic public.

In this paper, we have argued for the use of quali-quantitative techniques to study digital democracy platforms. Importantly, techniques like bi-partite networks are not a

universal solution but must emerge from the specificity of the platform (and possibly the issue). In this case the subtler gradations of gravity-based clustering acts as a counterpoint to the in-or out groupings generated by the algorithm and depicted through the public facing visualizations. Bi-partite networks, however, are much harder to explain to non-technical informants and topic experts, so further work is needed to examine what kinds of maps could be best used as part of digital democracy platforms, not just for research into them.

One important dialogic aspect of this procedure, which might be integrated into the development of future maps, was the continual questioning or reframing of what the issue was really about. We noted that such reframings were more or less ignored by a process which reduced votes to an opinion about the issue. Perhaps in future we could develop algorithms which sort publics not in terms of opinions but in terms of what is *relevant* to them (Marres, 2012): to sort publics based on shared stakes, rather than different opinions.

Notes

1. From an interview by one of the authors with a Pol.is developer.
2. These range from older petition signing websites, like MoveOn.com and Change.org, to more advanced forums for hosting debates (including Kialo, Wiki Surveys (Salganik & Levy, 2015), Loomio, Consul, Decidim, Make.org – see Small et al., 2021)
3. As she explains with the example of Facebook: comments, likes and other interactions are fed into an algorithm which sorts which content to show particular users – based on what is popular, what is ‘fresh’ and what pertains to a particular user’s interests, based on their past interactions.
4. There are indications that the mathematical problems associated with bi-partite networks have been contemplated even before the invention of graph theory in the 18th century by Euler (Biggs et al., 1986) and the term bipartite has a wide use in mathematics to mean a set which is partitioned. The term only seems to have been associated with networks in the 40s and 50s (sometimes called bigraphs), but really only came to prominence in the 90s and early 2000s when the study and computational visualization of large, complex empirical networks became tractable (Asratian et al., 1998; Guilleme & Latapy, 2006).
5. Although they do not appear often in published papers, bi-partite graphs are frequently used in workshops and data sprints hosted by the Digital Methods Initiative in Amsterdam and the Techno Anthropology Lab.
6. For posts, this included time stamp of post, and number of positive and negative votes accrued for each daily time slice. For users, this included group id (opinion cluster) as determined by the algorithm, the total number of votes, total positive votes and total negative votes for each daily time slice. We experimented with, for example, colouring the comments by the proportion of negative and positive votes but settled on the current settings as the easiest way to read the maps.
7. Since the size of the comments would dwarf that of the users in this scale, we have chosen a non-linear relationship between these counts and size, such that users who vote more than the average appear larger than they normally would and are easier to see. This was done with the Spline function in Gephi.
8. It has long been understood that in public participation exercises, the problem definition or the question posed can have a huge influence over the proceedings (Wilsdon & Willis, 2004; Wynne, 2011).
9. If a comment contained two contradictory opinions, or an equivocation, it would not be clear which comment the vote was in support of.

10. Also, as we have noted, the current visualization does not take into account negative votes, but could do so in future.

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Appendix

The following table contains the full list of comments submitted as part of the Uber exercise. Comments are given an ID based on the order in which they are submitted and authors in the order they participate. Moderated comments designated -1 appear to have been deleted but may have accrued votes while they were still visible. All texts translated by one of the authors.

author id	comm id	comment_text	timestamp	moderated
0	0	I have used Uber app/service	Tue_Jun_30_01:49:52_PDT_2015	1
0	1	I am a Taxi driver	Tue_Jun_30_01:50:17_PDT_2015	-1
0	2	I am a Uber driver	Tue_Jun_30_01:50:33_PDT_2015	-1
0	3	I think Uber can increase the price of its service during the peak time	Tue_Jun_30_01:51:36_PDT_2015	1
0	4	I think taxi and Uber drivers should be able to work for different taxi companies	Tue_Jun_30_01:53:42_PDT_2015	1
0	5	I think it is the Ministry of Transportations responsibility to actively crack down unlicensed taxi	Tue_Jun_30_01:54:09_PDT_2015	1
0	6	I think Uber cars should be clearly signified	Tue_Jun_30_01:54:37_PDT_2015	1
0	7	I think Uber drivers should be covered by insurance	Tue_Jun_30_01:55:36_PDT_2015	1
0	8	I think Uber company should pay tax to the government in the locality where it operates	Tue_Jun_30_01:56:17_PDT_2015	1
0	9	I think Uber company should report any quarrel settlements to the Ministry of Transportation	Tue_Jun_30_01:58:08_PDT_2015	1
2	10	I have used Uber service outside of Taiwan	Tue_Jun_30_02:27:46_PDT_2015	1
2	11	I would like to tell you a secret	Tue_Jun_30_02:28:44_PDT_2015	-1
20	12	Uber companay is a matchmaker type of platform just like other ecommerce platforms. It is considered as IT industry.	Tue_Jun_30_05:36:59_PDT_2015	1
0	13	I think Taxi should be painted yellow the legal colour for Taxi in Taiwan in order to differentiate itself from other cars	Tue_Jun_30_22:54:39_PDT_2015	1
0	14	I have a driving licence	Thu_Jul_02_18:05:05_PDT_2015	1
0	15	I have an occupational driving license	Thu_Jul_02_18:05:19_PDT_2015	1
0	16	Uber cars should take out insurance for their passengers'	Thu_Jul_02_22:20:24_PDT_2015	1
0	17	Uber company is part of the service industry because it employs drivers to offer its service	Sun_Jul_05_02:13:27_PDT_2015	1
0	18	Uber is a risky service because it does not operate as a legal business	Wed_Jul_15_05:57:00_PDT_2015	1
0	19	I have doubts about Uber service because its managment system is not transparent	Wed_Jul_15_05:57:11_PDT_2015	1
0	20	I think Uber company has created an unfair competition in domestic transportation industry.	Wed_Jul_15_05:57:14_PDT_2015	1
0	21	According to the regulation Uber should be made to register as a transportation business [rather than as a software business]	Wed_Jul_15_05:57:18_PDT_2015	1
88	22	I think every Uber driver should take insurance for its passengers	Thu_Jul_16_18:44:06_PDT_2015	-1
88	23	I think the government should take control over the individual profile of all drivers	Thu_Jul_16_18:44:34_PDT_2015	-1
0	24	I think the government should take control over the individual profile of all Uber drivers	Thu_Jul_16_19:08:33_PDT_2015	1
74	25	The Ministry of Transportation has already orderd Uber company to suspend its business. Why does the ministry of transporation still allow Uber to continue its operation? I would regard	Thu_Jul_16_20:22:05_PDT_2015	-1

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author id	comm id	comment_text	timestamp	moderated
		the government as incapable if it cannot follow the regulation and crack down the illegal business Uber company		
96	26	Uber company is ordered by the government to suspend its business. How can it still operate in Taiwan? Allowing the Uber service to exist shows how incapable this government is how untrustworthy this government is. I am very worried about the situation when it is citizens who have to take actions against the illegal business	Thu_Jul_16_20:40:26_PDT_2015	-1
103	27	I think the Uber company has breached the associated regulation because it provides Taxi service as a registered IT company instead of as a transportation company. In addition Uber drivers do not have to pass the qualification exam to become a Taxi driver. Who will take the responsibility if there is an accident? Is it the government? The government should take Ubers business licence away.	Thu_Jul_16_20:42:08_PDT_2015	-1
108	28	No insurance no protection	Thu_Jul_16_20:44:16_PDT_2015	-1
0	29	I think the Ministry of Transportation has poorly controlled illegal business like Uber which indicates its incapability	Thu_Jul_16_20:52:54_PDT_2015	1
0	30	I think the government should endeavour to suspend Ubers business. Citizens do not have to express their opinions on this matter.	Thu_Jul_16_20:53:54_PDT_2015	1
0	31	I think Taipei City Hall should annul Ubers company licence as Taiwan Uber Digital given the fact that the Ministry of Transportation has turned down Ubers appeal.	Thu_Jul_16_21:01:25_PDT_2015	1
0	32	I dont feel safe if Uber company does not take out insurance for passengers.	Thu_Jul_16_21:02:20_PDT_2015	1
106	33	I think Uber service should not exist. Its service charge is not reasonable. It also badly manages cars and drivers. Drivers are not trained professionally.	Thu_Jul_16_21:04:25_PDT_2015	-1
0	34	I think Uber drivers should obtain an occupational driving licence.	Thu_Jul_16_21:09:02_PDT_2015	1
0	35	I think Uber company does not strictly examine the quality of Uber drivers.	Thu_Jul_16_21:10:32_PDT_2015	1
158	36	How can Uber company make money in Taiwan but not pay tax to the Taiwanese government? Which stance does the government take in this matter? Does the government suggest citizens can also conduct illegal activities? Illegal activities should be cracked down! Uber drivers do not pass the same qualification exam as taxi drivers are their cars legally registered? Do they take insurance? It is obvious that what they are doing is illegal in particular hidden behind the name of digital technology. The government lost trust from citizens by not taking action against Uber.	Fri_Jul_17_02:47:19_PDT_2015	-1
0	37	I think governmental institutions from different levels should express their opinions about the Uber issue before the consultation process starts.	Fri_Jul_17_03:29:04_PDT_2015	1
2	38	Uber is preferable to a conventional taxi if I am not in a rush	Fri_Jul_17_09:09:10_PDT_2015	1

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author id	comm id	comment_text	timestamp	moderated
2	39	Uber is of better quality than a taxi	Fri_Jul_17_09:09:37_PDT_2015	1
336	40	I think Uber should better scrutinise the quality of its drivers ensure the safety of passengers. Safety is the first priority.	Sat_Jul_18_04:07:17_PDT_2015	1
20	41	The Ministry of Transportation should publish its investigation on Uber company.	Sat_Jul_18_04:40:56_PDT_2015	1
331	42	To me taxi cars are legally registered for its business operation whereas unlicensed cars are not fit for the Taxi service because they jeopardise the safety of the public. I dont understand why the government has not dealt with this issue.	Sat_Jul_18_08:24:05_PDT_2015	-1
2	43	I have used Uber service	Sat_Jul_18_09:01:54_PDT_2015	1
0	44	Uber service has jeopardised the safety of the public by using unlicensed taxi cars	Sat_Jul_18_09:56:19_PDT_2015	1
371	45	I think Uber should consider incorporating the idea of carpooling in its service	Sat_Jul_18_22:56:16_PDT_2015	-1
0	46	I think Uber should consider incorporating the idea of carpooling in its service whilst passengers still have to pay for it	Sat_Jul_18_22:58:04_PDT_2015	1
460	47	I think Uber company disguised under its claim for benefiting everyone is only interested in making profits by finding loopholes	Mon_Jul_20_18:14:11_PDT_2015	-1
0	48	I think Ubers business mode cannot afford to pay tax and take insurance	Mon_Jul_20_18:19:09_PDT_2015	1
464	49	In Taipei metropolitan area Taxi drivers are subject to a fierce competition against various modes of public transporation metro bus ubike etc. Allowing Uber company to provide its service would make Taxi drivers life more difficult. Please think twice!	Mon_Jul_20_18:28:52_PDT_2015	-1
0	50	Allowing Uber company to offer its service would only make taxi drivers difficult to survive	Mon_Jul_20_18:34:03_PDT_2015	1
476	51	I consider any profitoriented innovative service as the key to social progress but its operation has to comply with the law and regulation. In doing so not only illegal activities but also the concerns for inequality and safety are prevented	Mon_Jul_20_19:36:43_PDT_2015	1
56	52	Uber offers a winwin service for both passengers and drivers	Mon_Jul_20_20:37:15_PDT_2015	-1
483	53	Uber offers a winwin service for both passengers and drivers	Mon_Jul_20_20:39:43_PDT_2015	1
485	54	Uber service as it involves the regulations about passengers and transporation needs to be thoroughly scrutinised.	Mon_Jul_20_22:55:01_PDT_2015	-1
0	55	I consider Uber as transportation service and therefore it needs to be thoroughly scrutinised	Mon_Jul_20_23:48:06_PDT_2015	1
503	56	I think Uber company should financially contribute to the local government and the society where it operates	Tue_Jul_21_03:56:03_PDT_2015	-1
503	57	I think transportation providers Uber should ensure passengers remain safe and the government should treat all providers equally.	Tue_Jul_21_03:56:22_PDT_2015	-1
503	58	I think the quality of Uber cars is higher than taxi cars	Tue_Jul_21_03:57:14_PDT_2015	-1
503	59	I think using the Uber APP can prevent drivers from taking a detour	Tue_Jul_21_03:57:49_PDT_2015	1
505	60	I think that many taxi drivers have a bad driving behaviour	Tue_Jul_21_04:06:21_PDT_2015	-1

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author id	comm id	comment_text	timestamp	moderated
505	61	I think sharing economy can reduce waste of social resources	Tue_Jul_21_04:07:30_PDT_2015	1
505	62	I think Uber company can offer an opportunity for flexible employment	Tue_Jul_21_04:09:18_PDT_2015	1
205	63	I think the uneven quality of Taxi service is a result of an unfair competition in transportation industry.	Tue_Jul_21_05:19:40_PDT_2015	1
509	64	I think Uber is a foreign company. It is its responsibility to come up with a solution to its taxation issue in Taiwan.	Tue_Jul_21_05:22:35_PDT_2015	1
0	65	I think the government should establish a fair regulation for all transportation providers rather than protect specific ones.	Tue_Jul_21_05:51:56_PDT_2015	1
531	66	I think Uber drivers drive more carefully than Taxi drivers	Tue_Jul_21_23:29:51_PDT_2015	1
531	67	Uber service offers me a sense of refreshment by giving passengers the chance to experience different highend cars Audi BMW Benz ... whereas most taxi cars are domestically manufactured.	Tue_Jul_21_23:33:48_PDT_2015	1
533	68	I think we are now living in a digital age where regulation and law should change accordingly rather than remain fixated.	Tue_Jul_21_23:41:06_PDT_2015	1
533	69	I feel safe when using Uber service because it records and tracks every trip. I am not that bothered about Uber drivers not having an occupational driving licence	Tue_Jul_21_23:44:27_PDT_2015	1
528	70	Uber service is cheaper than Taxi. On average the cost that Ive saved by taking Uber amounts to a meal	Wed_Jul_22_00:02:19_PDT_2015	-1
527	71	I consider Uber as a sharing platform instead of an employer. Uber company operates as a platform manager to organise drivers and passengers.	Wed_Jul_22_01:08:11_PDT_2015	1
0	72	Uber service is cheaper than Taxi. On average the cost that Ived saved by taking Uber amounts to a meal	Wed_Jul_22_05:40:38_PDT_2015	1
600	73	I consider Uber as Taxi service and therefore it needs to obtain an occupational driving registration and display it inside the car.	Wed_Jul_22_09:03:39_PDT_2015	-1
608	74	I think Uber service does not follow the same regulation as Taxi. Taking rides from unlicensed private cars makes me feel very scary and unsafe	Wed_Jul_22_09:16:15_PDT_2015	-1
613	75	I think both Uber and Taxi companies should follow the law	Wed_Jul_22_09:16:49_PDT_2015	-1
601	76	I think it is risky to take rides from private cars	Wed_Jul_22_09:17:39_PDT_2015	-1
0	77	I think Uber service should be treated the same as taxi service. Taxi registration and driving licence should be displayed in obvious locations within the car	Wed_Jul_22_09:17:57_PDT_2015	1
0	78	I think it is risky to take rides from private cars because I cannot tell whether the driver has passed the Taxi driver qualification exam or not.	Wed_Jul_22_09:28:07_PDT_2015	1
639	79	Ubers logic of fee calculation does not make sense to me. It does not calculate the fee based on the realtime situation of demand and supply but based on specific time classification. It seems strange to me that sometimes the price	Wed_Jul_22_09:56:27_PDT_2015	-1

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author id	comm id	comment_text	timestamp	moderated
		for Uber black is cheaper than the price for Uber X.		
0	80	The logic through which Uber calculates its fee appears opaque to me. Sometimes it is cheaper to take Uber Black than Uber X.	Wed_Jul_22_09:59:02_PDT_2015	1
655	81	I think it is fine but it would be better if it is open to the public	Wed_Jul_22_10:09:51_PDT_2015	-1
655	82	I think taxi drivers will find a way to survive just as how they joined occupational associations to survive in the past	Wed_Jul_22_10:22:38_PDT_2015	-1
655	83	I think so and it needs to be justified	Wed_Jul_22_10:24:39_PDT_2015	-1
0	84	It is a good thing that Uber company challenges the tradition that Taxi drivers have to join the occupational associations in order to survive	Wed_Jul_22_10:29:53_PDT_2015	1
730	85	I think Uber company including drivers and business mode has to comply with associated regulations in Taiwan	Wed_Jul_22_17:01:06_PDT_2015	-1
449	86	I consider Uber as an illegal and unfair operation which has heavily threatened the livelihood and right of Taxi drivers.	Wed_Jul_22_19:01:08_PDT_2015	-1
852	87	I think the way in which Uber increases its price may put people off but it makes sense to me because there is a rule by which Uber calculates its fee.	Wed_Jul_22_20:33:14_PDT_2015	1
528	88	If I encounter any issues with Taxi drivers I will have no one to turn to. In the case of Uber I can easily use customer service to make complaints.	Wed_Jul_22_20:34:48_PDT_2015	-1
852	89	I really like Uber service	Wed_Jul_22_20:35:07_PDT_2015	-1
0	90	To me Ubers customer service is more efficient in solving issues than a Taxi company	Wed_Jul_22_20:41:50_PDT_2015	1
528	91	I think Uber provides the public with a convenient mode of transportation. Uber also has a mechanism to ensure passengers rights.	Wed_Jul_22_21:31:39_PDT_2015	-1
0	92	Considering that Uber has already established a mechanism to ensure passengers rights it can really benefit the public if Uber is allowed to operate in Taiwan.	Wed_Jul_22_21:39:18_PDT_2015	1
886	93	I think we focus too much on Uber service. Instead we should start to think about wider issues related to selfdriving cars. How should we govern selfdriving cars? Whether selfdriving cars are going to replace the current modes of public transportation? What should we do with Taxi drivers if they are unemployed?	Wed_Jul_22_22:36:23_PDT_2015	-1
0	94	I think we need to consider the issues regarding selfdriving cars and Taxi drivers unemployment.	Wed_Jul_22_22:42:43_PDT_2015	1
951	95	Uber has implemented a rating system for Uber drivers and customers. Lowrated drivers will be subject to further training or penalty whereas illbehaved Taxi drivers can still do their jobs. This is the difference between Uber and Taxi service. I feel safe about Uber service. I wont take Taxi because Taxi drivers do not drive carefully.	Thu_Jul_23_00:37:04_PDT_2015	-1
0	96	I think customers not just the government should be able to rate Taxi cars	Thu_Jul_23_00:40:37_PDT_2015	1
950	97	Uber has to comply with local regulations this means to use rental cars	Thu_Jul_23_11:02:26_PDT_2015	-1
950	98	The idea of carpooling means to go to the same destination not to take a detour like Taxi	Thu_Jul_23_11:04:34_PDT_2015	-1

(Continued)

Continued.

author id	comm id	comment_text	timestamp	moderated
950	99	N/A	Thu_Jul_23_11:07:11_PDT_2015	-1
0	100	I think the idea of carpooling has to be understood as both driver and passengers are going to the same destination. Carpooling does not mean to drive around and wait for potential customers.	Thu_Jul_23_12:34:48_PDT_2015	1
1052	101	I think Uber is a provider for transportation service therefore It needs to take specific insurance that fit to its service.	Thu_Jul_23_21:22:38_PDT_2015	-1
1052	102	I dont think Uber cars have to be painted yellow or any other specific colour because they are considered as ondemand car service.	Thu_Jul_23_21:23:33_PDT_2015	-1
1052	103	Considering Uber company has charged extra administration fee it needs to ensure the quality of both Uber drivers and service.	Thu_Jul_23_21:24:51_PDT_2015	-1
0	104	Considering Uber company has charged administration fee it needs to take out insurance for passengers. When it is necessary Uber company should provide customers with specific types of insurance.	Fri_Jul_24_00:43:00_PDT_2015	1
919	105	To me Uber is a great platform and a great mode of transportation. Taxi is not our only choice.	Fri_Jul_24_07:04:05_PDT_2015	-1
1081	106	I think we need to create a new regulation which allows unlicensed private cars to offer carpooling service	Fri_Jul_24_19:00:38_PDT_2015	1
1084	107	I think that Uber service is of higher quality and safety than a Taxi	Sat_Jul_25_00:22:00_PDT_2015	-1
1089	108	I think Uber is a platform which signifies a global phenomenon for e-commerce platform. Taiwan needs to be part of this.	Sat_Jul_25_01:40:50_PDT_2015	-1
0	109	Uber is a global platform. If Taiwan wants to be part of this globalisation we need to accept it.	Sat_Jul_25_01:49:51_PDT_2015	1
1137	110	I do not mind using either Uber or Taxi service as long as drivers hold a driving licence and take out insurance for passengers. Can we not as customers to choose whichever mode of transportation to our liking? If the transport provider makes sure the high quality of its service it will remain appealing to the public. This is why many have chosen to use Uber service.	Sun_Jul_26_20:21:17_PDT_2015	-1
1084	111	I think the government should improve both the quality and the management of Taxi service. Taxi can offer a great service just as Uber.	Sun_Jul_26_20:32:39_PDT_2015	1
1136	112	I think the government should adapt its regulations to the new digital service. It should not impose the old regulations on the new digital service.	Sun_Jul_26_20:46:15_PDT_2015	-1
1213	113	I like the idea of carpooling. It can offer bespoke transportation service based on the realtime demand. We should not use taxpayers money to financially support Taxi drivers. We should let the market decide.	Mon_Jul_27_16:48:59_PDT_2015	-1
1234	114	I think Uber provides a convenient and high quality service.	Mon_Jul_27_20:59:17_PDT_2015	-1
1234	115	I think Uber provides a convenient and high quality service.	Mon_Jul_27_21:00:21_PDT_2015	-1
1234	116	I think Uber provides a convenient and high quality service.	Mon_Jul_27_21:02:33_PDT_2015	-1
1270	117	I think Uber provides a convenient and high quality service.	Mon_Jul_27_21:04:15_PDT_2015	-1

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author id	comm id	comment_text	timestamp	moderated
1244	118	Uber should be allowed to operate.	Mon_Jul_27_21:26:49_PDT_2015	-1
0	119	It does not make sense to me that Taxi company wants to increase its service price as Taxi drivers already receive financial benefits from the government. We should allow Uber to compete against Taxi companies and let the market to decide which is better.	Mon_Jul_27_21:56:34_PDT_2015	1
1324	120	I think any usage of private cars for the purpose of transporting passengers should be registered and regulated. Such usage is allowed twice per day and has to take insurance for passengers.	Tue_Jul_28_21:56:56_PDT_2015	1
1440	121	I choose to use Uber service because it offers a better quality service than Taxi. Taxi drivers do not fulfill my demands with a polite attitude. I hope Uber can remain its current status.	Tue_Jul_28_23:39:02_PDT_2015	1
1431	122	I think Uber should be treated the same as Taxi service. All Uber drivers have to pass both the driving test and the driver qualification test organised by the Ministry of Transportation. Obtaining a commercial registered licence ensures both the quality service for customers and the basic right of drivers.	Tue_Jul_28_23:39:07_PDT_2015	1
1406	123	Regarding the question whether we need a new regulation or revise the current regulation for Uber I think it depends on how much influence Uber has. In my view Uber does not have a great impact on our everyday life. I will agree to revise or establish new regulation if the public thinks Uber indeed possess a significant influence over their life.	Tue_Jul_28_23:40:19_PDT_2015	1
1937	124	Uber is a great platform for transportation with a good rating system. Competition is necessary for service improvement.	Wed_Jul_29_00:12:41_PDT_2015	-1
1398	125	It is not because Uber does not want to be legalised. The government does not want to legalise Uber for protecting Taxi drivers.	Wed_Jul_29_00:20:16_PDT_2015	-1
1960	126	I think every customers travelling route should be tracked and recorded by GPS devices. If there is anything happened then the police can use the location data to assist investigation.	Wed_Jul_29_00:28:50_PDT_2015	1
1960	127	I think only citizens with a clean driving record are allowed to work as Uber drivers	Wed_Jul_29_00:29:14_PDT_2015	-1
1960	128	I think Uber drivers because of using their own cars carefully follow the traffic regulations not like Taxi drivers who drive too fast.	Wed_Jul_29_00:29:31_PDT_2015	1
1960	129	I think Uber customers can rate drivers including Taxi drivers. If a Taxi driver receives a rate lower than the standard his/her contract can be terminated. With this rating system drivers will be motivated to offer a better service for customers.	Wed_Jul_29_00:29:49_PDT_2015	-1
1960	130	There are three advantages of using Uber service. Firstly I as a passenger do not feel worried about not having the right amount of cash and coins. Secondly drivers also do not need to carry coins and cash. Thirdly drivers will not feel worried about being robbed at night.	Wed_Jul_29_00:30:33_PDT_2015	-1
1248	131	I think Uber is better than Taxi.	Wed_Jul_29_01:03:40_PDT_2015	-1
1942	132	I believe that competition is the key to improvement. The government should discuss	Wed_Jul_29_01:57:38_PDT_2015	-1

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author id	comm id	comment_text	timestamp	moderated
		with Uber company about how Uber can correct its illegal activities. Both drivers and passengers have a positive experience of Uber service. I hope the government can take this issue seriously.		
1816	133	To legalise Uber service is to offer a better protection for customers and drivers. I hope that the Taiwanese government can create a legislation for Uber service.	Wed_Jul_29_05:47:59_PDT_2015	1
2354	134	Taxi is a high profit business. I don't understand why it has to further increase its service fee.	Wed_Jul_29_11:46:39_PDT_2015	-1
2354	135	If Uber can follow a transparent method to calculate its service fee and make sure not to take a detour it will attract more customers.	Wed_Jul_29_11:51:54_PDT_2015	1
2389	136	Uber provides a better and more convenient service than Taxi. We should revise the regulations related to the Taxi service and operation.	Wed_Jul_29_20:38:03_PDT_2015	-1
2389	137	It is risky for me to take Taxi due to the various quality of drivers and cars.	Wed_Jul_29_20:42:24_PDT_2015	1
1476	138	Uber drivers only work parttime whilst taxi drivers work fulltime and enjoy extra stipends from the government. It is clear to the public who gains the advantage. The government should think from the viewpoint of the public instead of helping those who do not take their job seriously.	Wed_Jul_29_20:54:50_PDT_2015	-1
1308	139	I think Uber indicates a timely response to the demand in our society. We should find out what are the questions and try our best to solve them.	Wed_Jul_29_22:12:25_PDT_2015	1
1084	140	Unlicensed taxi is a very common phenomenon in places outside of the Taipei Metropolitan. This type of taxi tends to set up its own rule of pricing. Why do we regulate all of the unlicensed taxi?	Thu_Jul_30_09:32:53_PDT_2015	1
258	141	Paying tax is an obligation for every business that operates in Taiwan. Uber despite its innovative business mode has to pay tax to the Taiwanese government	Fri_Jul_31_18:54:41_PDT_2015	1
2569	142	If you don't like Uber service you don't have to use it. You cannot force others not to use it.	Thu_Aug_06_04:46:01_PDT_2015	-1
2582	143	I think the government should formulate a regulation which addresses what are the minimum requirements for protecting drivers passengers and pedestrians. Let the rest be decided by the market.	Thu_Aug_06_21:56:43_PDT_2015	1
1676	144	Allowing Uber to operate its business in Taiwan can improve our competitiveness.	Sun_Aug_09_05:14:08_PDT_2015	1