Twitter as a giant ideabox – Systematically identifying customer needs regarding the Ring Video Doorbell through analysis of tweets

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ABSTRACT

This thesis builds upon the Needmining method described in Kühl et al. (2016). To expand the scope of this method, the BERT model was applied to a dataset of Twitter microblogs concerning the Ring Video Doorbell. The model was found to provide relatively accurate predictions with relatively high recall and precision, proving the Needmining method to be effective beyond the scope of e-mobility. Through manual assessment of 10.000 tweets, 875 'need tweets' were identified, distributed across 15 main categories and 54 subcategories. Analysis of Twitter data was found to be a viable method for innovation managers for identifying customer needs for the Ring Video Doorbell. Furthermore, to provide more refined managerial insight, the main categories were placed within the model of Kano et al. (1984) through the analysis of complaints and compliments (ACC). Although this method was found to be unreliable, it still provided meaningful insights in some need categories.

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Keywords
Social media marketing, text mining, customer need analysis, machine learning, needmining

1. PROBLEM STATEMENT

Understanding customer needs is a vital asset in the innovation process (Weckenmann, Akkasoglu and Werner, 2015; Kafetzopoulos, Gotzamani and Gkana, 2015). Modern corporations use extensive market research methods to identify exactly what their customer base expects from the products they develop. Herein, direct feedback from end-users is one of the most valuable means of acquiring information regarding customer needs (Edvardsson et al., 2012; Birch-Jensen, 2020). Conventional efforts for acquiring first-hand customer need intelligence such as customer surveys and interviews are often costly and time consuming while response time is slow (Hauser and Griffin, 1993). Simultaneously, the emergence of social media has provided customers with an openly accessible digital platform to ventilate their opinions on anything – including the products they buy – on a completely unstrained basis. Whenever an exciting innovation comes out, numerous users immediately take to their social media channels to reflect on their experiences. A particularly interesting platform for digital marketeers in the realm of social media is Twitter, which provides an impressive database containing numerous micro-blogs. By entering keywords in Twitter´s API these data are within reach at relatively low cost, and can be adopted without legal restrictions. Embedded in over 500 million daily tweets from over 190 million unique daily users (Twitter, 2020) potentially lays valuable information about desired features, characteristics and aesthetics of, as well as frustrations with, numerous products (Lusch et al., 2010).

The problem is that often this information is overlooked due to a lack of low-effort systematic analysis (Lusch et al., 2010; Brunschwicker, Bertino and Matei, 2015), potentially making understanding of customer needs incomplete. As a consequence, corporations develop sub-optimal innovations that do not achieve their full marketing potential, and customers are left with disappointing products. Additionally, marketing and branding efforts may miss their targets due to unawareness or underestimation of specific customer needs.

Over the last few years several systematic approaches have been developed to making sense of customer needs through vast numbers of tweets regarding specific products. Kühl et al. (2016) have developed a methodology for so-called Needmining, where machine learning is used for automated classification of customer needs in Twitter data. In the article it is stated that "in order to be suitable for testing the approach, candidate domains are required to be both dependent on fast and ongoing monitoring of arising needs and rich in micro-blog traffic" (Kühl et al., 2016). As a widely adopted tech-product, the Ring Video Doorbell (RVD) meets these requirements. In this paper, the aim is to apply Needmining methods to the RVD to (I) test the Needmining method's effectiveness and accuracy and (II) explore the customer needs regarding the RVD. The research questions associated with these aims are:

(I) What are the main customer needs that can be deducted from tweets regarding the Ring Video Doorbell through systematic analysis using Needmining?

(II) How accurate are Needmining methodology machine learning techniques in classifying tweets in the context of the Ring Video Doorbell?

Additionally, to further assess the relevance of identified customer needs along with their managerial implications, this thesis aims to categorise findings within the widely adopted Kano customer need model (Kano et al., 1984). This model differentiates between different types of attributes and factors in their relevance with regard to customer satisfaction.

2. LITERATURE REVIEW

2.1 Elaboration on Customer Needs

Understanding of the concept of customer needs is prone to interpretation (Bayus, 2008). Ever since the emergence of Maslow's (1954) famous hierarchy of needs it has been apparent that needs occur on different levels. Kotler and Armstrong (2001) distinguish between needs, wants and demands, where needs encompass the wishes of customers, wants regard the means of satisfying the needs, and demands are wants backed with an ability to acquire.

In this thesis, a customer need can be understood as any customer expectation, wish or requirement regarding both physical and service attributes of a consumed product. This definition is in line with the work of Kühl et al. (2016) which this thesis builds upon.

2.2 Importance of Customer Needs in Marketing and Innovation Processes

With increased customer power in quality assessment, their wishes are nowadays playing a central role in quality management (Weckenmann, Akkasoglu and Werner, 2015). A firm's ability to learn about these wishes, together with customer focus are two important pillars in quality management, which have a significant contribution to innovation practices, which directly influence competitive advantage (Kafetzopoulos, Gotzamani and Gkana, 2015). Customer needs are relevant in both business-to-customer (Hallencreutz and Parmler, 2019; Chen, Chiang and Storey, 2012) and business-to-business (Kärkkäinen and Elvengren, 2002) contexts. Cooper and Kleinschmidt (1984) articulate defining customer needs, wants, preferences and product requirements as one of the main success factors in product innovation. Furthermore, understanding what the customer wants is found to be fundamental for effective advertising and marketing practices (Weckenmann, Akkasoglu and Werner, 2015).

On the contrary, Evanschitzky et al. (2012) found no significant correlation between customer needs – or any marketplace factors for that matter – and product innovation success. In their meta-analysis they emphasise on strategy and cultural factors as main success factors in innovation. Nevertheless, undeniably, the quest to acquiring extensive information regarding customer requirements, needs and wishes generally encompasses a major share of any firm's marketing operations and can reveal valuable knowledge about the marketplace in any industry.

2.3 Customer Need Dynamics

In order to further understand the managerial implications of the variety of costumer needs a marketeer may find, the Kano model was developed (Kano et al., 1984). In his model, Kano argues that the presence of not all product attributes have a linear effect on customer satisfaction, and he makes the important distinction between basic expectations, performance factors and exciters (see figure 1). Basic expectations, so called "must haves", cannot contribute to high satisfaction, but when not properly met do leave customers very dissatisfied. Performance factors do have a linear effect on satisfaction, where the addition of a performance factor leads to increased satisfaction. Exciters, so called "wow-factors", follow an exponential effect on customer satisfaction and are generally factors that customers were not expecting in the first place. For this reason, their absence does not lead to dissatisfaction. It should be noted, however, that their effect does not occur when basic expectations are not met.

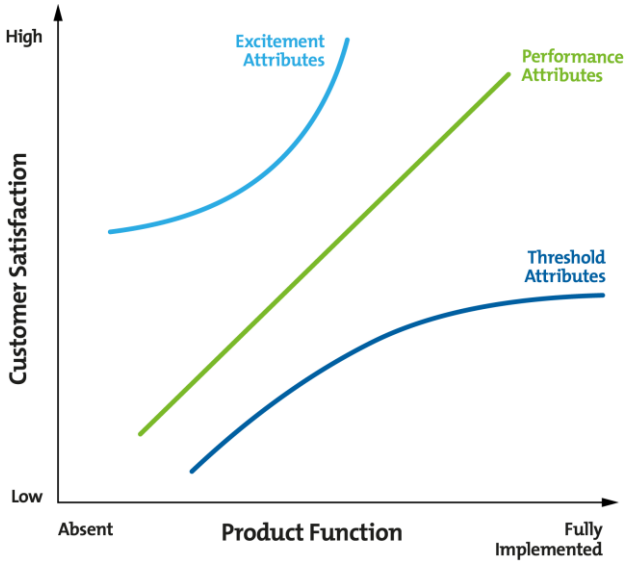

Figure 1. The Kano model (1984)

Originally, the creators of the Kano model provided structured questionnaires for positioning attributes in the model (Kano et al., 1984; Sauerwein et al., 1996). Mikulic and Prebezac (2011) critically assessed several other commonly practiced classification techniques, qualitative data being one. In using qualitative data, attributes are classified within the Kano model on the basis of analysis of complaints and compliments (ACC) (Mikulic and Prebezac, 2011). When complaints significantly exceed compliments, attributes are considered to be must haves; attributes wherein the amount of compliments and the amount of complaints are balanced are assumed to be performance factors, and; attributes where compliments are common and complaints are scarce are seen as exciters. Usually, the limitation in using qualitative data is that "the reliability of these techniques for classifying attributes according to the Kano model is questionable because it is impossible to discern whether the analysed research setting covers both very positive and very negative customer experiences for all attributes that emerge from the analysis (but which did not result in complimenting/complaining behaviour)" (Mikulic and Prebezac, 2011). However, it is also stated that "reliability certainly increases when studies are based on multiple cases" (Mikulic and Prebezac, 2011). Thus, it seems that when a large number of cases is considered, e.g. in utilising an extensive Twitter dataset, this limitation can be overcome. This is further confirmed by Sony, Antony and Douglas (2020), who claim that Kano attributes can be accurately analysed using big data sources such as social media.

Another problem arises with the ACC method: Presence or absence of an attribute may influence positioning within the model. For example, when Beiersdorf analysed customer needs for Nivea deodorant through Twitter data, they identified it was important that deodorant does not stain clothing (Roberts and Piller, 2016). One may wonder if this attribute is a "must have" or a "delighter". When the attribute is part of a product, it is likely that compliments along the lines of "I am so happy there is finally a deodorant that does not stain my clothes" emerge relatively frequently compared to complaints. Hence, following the ACC method, an analyst may classify 'does not stain clothes' as an exciter. However, when the attribute is absent, complaints along the lines of "I hate how my white shirt always gets nasty yellow stains from my deodorant" may arise and outnumber compliments regarding the matter. Thus, an analyst may conclude that this same attribute is not an exciter, but a basic expectation, given high number of complaints compared to compliments.

Indeed, customer needs can rapidly change (Lenka, Parida and Wincent, 2017; Hallencreutz and Parmler, 2019) and what may be performance or excitement attributes today can transform into "must haves" tomorrow. In order for businesses to adequately capture this transformation, customer needs must be monitored in real-time (Davenport, Barth and Bean, 2012; Hyun Park et al., 2017). In this paper, the Kano model will be applied using the ACC method to provide nuance to the findings.

2.4 Common Practice in Customer Need Analysis

Traditionally, firms have aimed to gain understanding of customer needs mainly through surveys, feedback requests and observation, which still find relevance today (Hauser and Griffin, 1993; Urban and Hauser, 2004; Edvardsson et al., 2012; Gupta, Belkadi and Bernard, 2017; Ruessmann et al., 2020; Birch-Jensen, 2020). In recent years, the emergence of big data analysis has been widely recognised to open an extensive window of customer need research opportunity (Chen, Chiang and Storey, 2012; Del Vecchio et al., 2018; Urbinati et al., 2019). Sony, Antony and Douglas (2020) deem a firm's capabilities in understanding big data vital in adapting to the so-called "industry 4.0" – the digitalised, data-driven modern day environment businesses operate in. Successful big data analysis allows for much quicker findings with regards to customer sentiment and response compared to traditional methods (Davenport et al., 2012), which contributes to the open innovation process (Del Vecchio et al., 2018). However, with firms often getting lost in the woods of big data, traditional small data analysis can prove to be more comprehensive (Birch-Jensen, 2020): "With big data, the main challenge many firms face today is not primarily access to customer feedback, but rather understanding how to navigate the abundance of customer feedback to mobilize quality improvements" (Birch-Jensen, 2020). A call for the development of novel analytical techniques for big datasets is also articulated by Lusch et al. (2010) and Brunschwicker et al. (2015).

An oversight of commonly used big data analysis tools is provided by Del Vecchio et al. (2018). In a customer need context, analytical techniques such as text mining have been used on online customer reviews (e.g. Rai, 2013). Beside open-source big data networks such as Hadoop and the cloud, social media is considered a highly relevant big data source in the open innovation context (Lusch et al., 2010; Davenport et al., 2012; Drexler et al., 2014; Roberts and Piller, 2016; Bertschek and Kesler, 2017). Social media databases can be accessed openly at relative low cost (e.g. Twitter API). Thus, given the aforementioned relevance of its potential implications combined with its accessibility, exploring such databases is certainly of interest to a wide variety of organisations.

2.5 Social Media Data Analysis Methods

After the emergence and popularisation of social media, initial research aimed to gain understanding in how firms could manoeuvre on social media platforms to provoke direct end-user engagement (e.g. Cooke and Buckley, 2008; Kietzmann et al., 2011), and assess the effectiveness of its social media operations (Hoffman and Fodor, 2008; Fischer and Reuber, 2011). Even now, social media data analysis as a practice is a field that can still be expanded, provided the knowledge gap resulting from an inability to grasp the exponential growth in data volume (Ahalt and Kelly, 2013; Drexler et al., 2014).

Over the last decade, several methodologies have been proposed to systematically gain insights from Twitter data with regard to customer needs. Misopoulos et al. (2014) made use of sentiment

analysis to identify customer needs in the airline industry. The functionality of analysing Twitter data has become evident: To illustrate, in the aforementioned Nivea deodorant example, acting upon Twitter generated customer needs led to the most successful product launch in the company's history (Roberts and Piller, 2016). A comprehensive, widely applicable method for analysing Twitter data has been developed in the form of so-called Needmining (Kühl et al., 2016). This method is the first to make use of machine learning techniques for automated identification of customer needs. Machine learning is an artificial intelligence technique which teaches a computer algorithm through data and experience (Mitchell, 1997). Machine learning methods improve efficiency in identifying needs from user generated content such as microblogs (Timoschenko and Hauser, 2019). The Needmining method however, does not allow for automated classification of needs (i.e. the algorithm can be taught to separate tweets containing customer needs from tweets not containing customer needs, but is not able to distinguish specific needs). This extension is provided by Kühl et al. (2019). However, the algorithm is still not capable of unsupervised learning and thus needs human interaction before it is able to classify needs. As a consequence, it cannot identify newly emerging needs in real-time (Kühl et al., 2019).

2.6 Needmining Efforts

Thus far, Needmining has been applied in the e-mobility sector (Kühl et al., 2016; Kühl et al., 2019). In literature at least, it has not yet been applied beyond the scope of this domain. That is not to say that this is impossible to do: Kühl et al. (2016) argue that Needmining methods can be applied to any domain that both requires fast and ongoing monitoring and is featured extensively in micro-blog traffic – it just has not been done yet. Here lays a research gap which this thesis aims to contribute to filling. Through applying the Needmining method to the Ring Video Doorbell this thesis seeks to validate this claim.

2.7 Ring Video Doorbell

The Ring Video Doorbell (RVD) is a smart home and home security product. It contains a high definition camera, a motion sensor and a speaker system that allows for two-way communication. Through an integrated app people can immediately see who is at the door and communicate. Furthermore, when the home owner is not home the system detects motion near the front door it starts recording and alerts users that someone was at their house. Users can then look at the camera footage to see who was there and what intentions this person had. Additionally, in an associated app neighbours can upload footage to e.g. identify suspects. This moderated platform also partners with local police departments.

The RVD (initially named DoorBot) was the flagship product developed in 2012 by Ring LLC, which was acquired by Amazon in 2018 for 839 million USD (Molla, 2019). The RVD is sold world-wide. Ring has not released sales figures, but it has been estimated around 400.000 Ring devices have been sold in December 2019 and Ring has claimed to have millions of customers (Molla, 2020).

With a wide range of tweets regarding the RVD in the last year and an innovative technological product background, the RVD appears to meet the requirements of extensive coverage in micro-blog traffic and a need for ongoing monitoring. Thus, it is suitable for the application of the Needmining method (Kühl et al., 2016).

3. METHODS

3.1 Elaboration on Needmining method

As mentioned previously, the Needmining method is evolved around Twitter data. These data are retrieved, then filtered, then labelled and eventually pre-processed (Kühl, 2016). After these steps, through machine learning an algorithm can assess which tweets from the dataset include a customer need. The needs are then manually categorised. Furthermore, in this thesis we manually identify complaints and compliments, which are then linked to specified needs in order to establish the ratio of complaints and compliments per need category. As a last step, following the analysis of complaints and compliments (ACC) the different need categories are placed in the Kano model (figure 2).

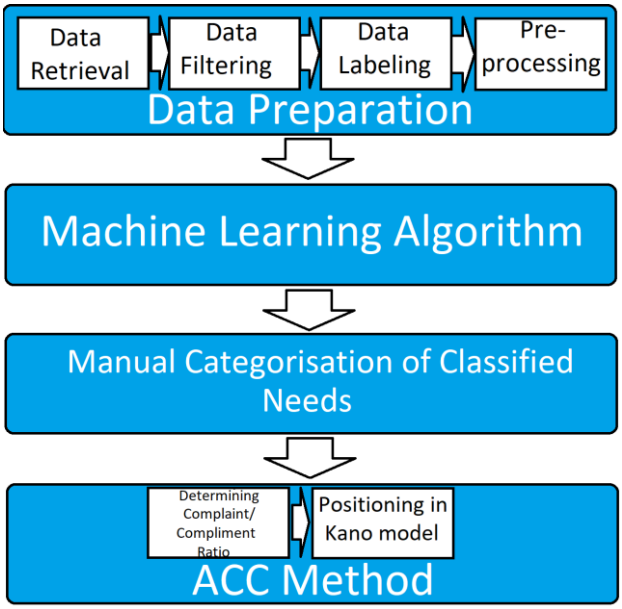

Figure 2. Method applied to dataset

3.2 Data Preparation

Before the machine learning algorithm can be applied to the dataset, the dataset needs to be prepared. To do so we follow four steps: Data retrieval, data filtering, data labelling and pre-processing.

3.2.1 Data Retrieval

The dataset is retrieved from Twitter API. To ensure the tweets that are retrieved concern the Ring Video Doorbell, we select several keywords. All tweets from the 24 months before May 2021 that contain these keywords are downloaded from Twitter API and included in the dataset. This means that we must be careful not to retrieve too many irrelevant data. For example, tweets containing the keyword "Ring" are typically not about the company Ring LLC and its doorbell. The keyword "Amazon Doorbell" often covers tweets concerning Amazon delivery employees who have been at the door, whereas "Ring Doorbell" mainly leads to results featuring the act of ringing a doorbell. After testing several keywords using the Twitter search engine, only "Video doorbell", "Camera doorbell", "Ring camera" and "Smart doorbell" consistently provided relevant results for the Ring Video Doorbell.

3.2.2 Data Filtering

The initial raw data set from Twitter API consists of all tweets written in English containing the aforementioned keywords "Video doorbell", "Camera doorbell", "Ring camera" and "Smart doorbell" that are not retweets. To be able to adequately train our machine learning algorithm, we only consider tweets

written in English. Furthermore, to reduce duplicates we do not include retweets, and further duplicated tweets are excluded from the dataset, since they do not contain new information and may skew the complaint/compliment ratio. Because false positives may occur from the machine learning algorithm identifying customer needs, we want to ensure tweets in our filtered dataset relatively frequently contain customer needs, and eliminate tweets that are relatively likely not to. Kühl et al. (2016) found that tweets containing URL links seldomly contain customer needs. Thus, tweets with URL's are eliminated from the dataset. It was also found that tweets consisting of less than 25 characters rarely contain customer needs, so these are also eliminated from the dataset. As advertisements and online sales efforts also do not express user needs we eliminate any tweets in the dataset including the stop words "sale", "win", "discount" or "deal". Some promotional tweets may still survive this filter, but we must be careful not to exclude tweets containing words that are likely to be used in advertisements, but also by consumers as valuable information may be lost.

After filtering our dataset is ready to be labelled.

3.2.3 Data Labelling

As we are applying a supervised machine learning algorithm, we first evaluate 10.000 random tweets in the dataset, which are our training data, by hand. Tweets including a customer need are labelled '1', the others are labelled '0'. When a tweet is labelled as a need-tweet, the same is done for assessing if a tweet contains a complaint or compliment (yes = '1', no = '0'), and if yes, which of the two it is (complaint = '0', compliment = '1').

The manual assessment of the training data is prone to interpretation and can be arbitrary. Some statements made in tweets fall in a grey area, where one could (indirectly) interpret something as a customer need. Here a decision needs to be made to either label everything that can be remotely considered as a customer need as '1', or only assign a '1' to tweets that clearly contain a customer need. This results in a tradeoff between a model that does not overlook any customer needs and a model that is more precise and, with a reduced number of false positives, not overfitted. Taking into account the purpose of Needmining, which is to efficiently identify customer needs from a large dataset, the decision is made to only assign a '1' to training data that contain a clear need, thus making the model more reliable.

3.2.4 Pre-processing

In the last phase of data preparation the dataset is pre-processed so that it becomes digestible for the algorithm. In the efforts of Kühl et al. (2016), here all text is tokenised, stemmed and down-cased, and stop words are removed. In this thesis we use the Bidirectional Encoder Representations from Transformers (BERT) model (Devlin et al., 2018) in Python, which does not need words to be tokenised and stemmed down and down-cased to be able to process them. Furthermore, the BERT model is able to analyse a word's context from stop words such as "or", "not" or "the". It assigns a unique number to each word and then correlates these numbers to the presence of customer needs in the training data. It will recognise commonly occurring stop-words (e.g., "the", "a", "or") and conclude that they do not influence the presence of a need in a tweet. Thus, we do not remove stop-words either.

3.3 Supervised Machine Learning AI

After preparing the data the BERT algorithm is run in Python. Provided the training data the algorithm automatically assigns probabilities to the remaining test data with regard to the presence of customer needs and the presence of complaints or compliments. We program the model to assign a '1' for customer needs each time a tweet has a probability of more than 50% of containing a customer need.

3.4 Manual Categorisation of Need Tweets

With the full dataset analysed, we filter out all tweets that do not contain a customer need. The remaining dataset is manually analysed to categorise the different need tweets based on common themes or features among them. Each need category is assigned a corresponding number.

3.5 ACC Method

Because the customer needs are categorised manually, it is decided to assign labels with regard to complaints and compliments to tweets containing needs by hand as well. We could use the algorithm for this initially, but it is likely to be less accurate. In assigning the labels by hand, the algorithm´s accuracy with regard to recognising complaints and compliments is assessed simultaneously, so that recommendations can be made for future applications of the BERT model regarding tweets containing customer needs. For assigning labels, the same method as in the training data is applied.

After assigning the labels each need category is assigned a score with regard to the emerging sentiment. This score is the mean of all '0's and '1's assigned associated with this category. This results in a score between 0 and 1, where a score close to 0 indicates the presence of relatively many complaints, a score around 0.5 indicates a balance between complaints and compliments, and a score close to 1 indicates the presence of relatively many compliments.

When a customer need category is found to have relatively many complaints associated with it, we classify it as a 'must have' in the Kano model. When it has a balanced complaint/compliment ratio we classify it as a performance attribute. When it has relatively many compliments associated to it, the customer need category is placed in the Kano model as an 'exciter'.

4. RESULTS

4.1 Needs Found

In total, 98.890 tweets were posted in the 24 months before May 2021 containing the keywords "Camera doorbell", "Smart doorbell", "Ring camera" or "Video doorbell". After removing duplicates, 96.603 tweets were left in the dataset. After applying the stop word filter, eliminating all tweets containing "Sale", "Win", "Discount" and "Deal" 15.307 tweets remained. After applying the >25 character filter, the eventual dataset consisted of 15.234 tweets. From the assessment of 10.000 tweets, 875 need tweets were found, which were distributed across 54 unique need (sub)categories. Table 1 provides an overview of the sixteen main categories and the corresponding complaint/compliment ratio. The C/C ratio was calculated on the basis of tweets including a complaint or compliment. Tweets containing no complaint or compliment were therefore excluded from this calculation.

Need Category	N_{Tweets}	$N_{Complaints/compliments}$	C/C Ratio
Privacy	164	66	0.015
No disturbance	135	83	0.024
Consistency	121	84	0.12
Being ‘smart’	98	39	0.26
Detecting/interacting with animals	65	20	0.95
Service	47	27	0.15
Flattering footage of owner	42	34	0.21
Cybersecurity	40	12	0.0
Offline/local options	35	21	0.0
Compatibility	34	8	0.5
Adjustability	16	4	0.5
Battery quality	15	12	0.25
Design	15	5	0.2
Camera quality	14	10	0.6
Feeling safe	13	8	1
Other	25		

Table 1. Overview of Need Categories and C/C Ratios

4.2 BERT Model Performance

In the scope of this thesis the guesses of the BERT model regarding whether a tweet contains a need or not are tested against the manually labelled dataset of 10.000 tweets. To assess the algorithm´s performance we look at its accuracy, precision, recall and F-scores. Accuracy indicates the proportion of correct guesses over the complete dataset. The algorithm’s accuracy was found to be 0.9173. Precision indicates the proportion of tweets considered to contain needs by the algorithm that were also considered to contain needs in the training set. The BERT model’s precision was 0.4931. Recall concerns the true positives, and can be understood as the proportion of tweets containing needs in the training set that were also identified by the algorithm. Recall was found to be 0.3715. The F-score provides a score for the algorithm’s overall performance taking into account both precision and recall and is calculated using the following formula:

$$F_\beta = (1 + \beta^2) \cdot \frac{Precision \cdot Recall}{(\beta^2 \cdot Precision) + Recall}$$

By assigning different values for β the F score can be adjusted to emphasise either precision or recall. One may do so for different managerial reasons, such as time-efficiency or completeness of information. In this thesis the same values for β are used as in Kühl et al. (2016) to be able to make a fair comparison between model performances. F_1 provides a balanced mean for the algorithm’s performance. The F_1 score is 0.4238. The $F_{0.5}$ score, which emphasises precision, is 0.4628. The F_2 score, which focusses on recall, is 0.3908.

5. DISCUSSION

5.1 Need Tweets

5.1.1 Significance of Needs Found

With 875 need tweets in 10.000 tweets a significant number of tweets regarding the Ring Video Doorbell contain a customer need. Applying the filters leaves a still extensive database of 15.307 micro blogs remaining. For reference, Kühl et al. (2016) found 332 need tweets in 2.396 tweets (post-filtering) regarding e-mobility, although it should be noted that they filtered out all non-German tweets instead of non-English tweets, which limits the scope in comparison to tweets written in English. Analysing Twitter data appears to be a meaningful method for innovation managers in gaining insights regarding customer needs for the RVD.

5.1.2 Need Categories

The Appendix section provides a random selection of tweets for each major need (sub)category provided in table 1. It should be mentioned that not only frequently occurring needs should be considered by innovation managers. Sometimes users came up with suggestions or feature requests that could potentially make for good innovation ideas, without the underlying customer need being mentioned in many more, if any, micro-blogs.

The need for privacy can be split into two subcategories. Firstly, there is a need for privacy from the outside world. People got concerned that e.g. the outside world will know when they are home, or were uncomfortable with the police being enabled to view footage without explicit permission. The other subcategory concerns privacy from family members. Often people were upset that family members or roommates could see them sneaking out or smoking.

Another major need category that was featured extensively is ‘No disturbance’. Many users felt they were receiving too many notifications, which were often about things they were not interested in. These disturbances could be greatly reduced if the RVD could (reliably) recognise neighbours and residents and would improve reliability in low-sensitivity modes

Consistency is also a main need category, consisting of sub-categories ‘Reliability’, ‘Functioning under all weather conditions’ and ‘Quick loading’. If the RVD did not function when it was needed (f.e. if it did not register someone stealing a package, or only loaded footage on the app once the visitor already left), people were left frustrated with the product.

Compatibility was frequently suggested by users. This could be in the realm of smart home platforms, but also notifications on applications such as virtual reality and Zoom were mentioned.

Design encompasses size, aesthetics, but also the sub-categories ‘wireless options’ and ‘robustness’. Users seem to prefer a small and subtle design, not in the last place because visitors and delivery drivers often tend to deliberately ignore the doorbell once they realise they are being recorded.

‘Camera quality’ encompasses all tweets regarding range, resolution and overall quality of the footage, as well as needs which would be met through high quality footage.

The need for adjustability originates mainly from users whose dogs would (quite strongly) react to hearing the doorbell ring, or hearing the doorbell chime on TV commercials. Additionally, there were some tweets requiring customisation for the fun of it. Note that under adjustability settings and preferences were not included, as those featured in a different need category.

Tweets containing a need for cybersecurity mainly originate from stories featured in the media on video doorbells being hacked. Many people expressed their distress and concern regarding the security of the device itself.

Many people reported getting excited by spotting rare animals, as well as monitoring or interacting with pets. Although few tweets hinted toward specific feature requests, ‘monitoring/interacting with animals’ is definitely a prominent use case for the RVD which could be capitalised on through innovation. This category often contradicts the category ‘no

unnecessary disturbances' which sees many people complaining about receiving notifications from cats or other animals. It should be noted that the RVD already allows for adjustments in sensitivity, recognising heterogeneity in customer needs.

The 'Service' category consists of the two sub-categories 'Customer support', which includes tweets from people requesting customer service to resolve problems, and 'Installation service', which shows some people struggle to install the RVD by themselves.

The category 'Local storage' consists mainly of people stating to be unwilling to commit to a subscription or people with privacy concerns who are uncomfortable with their data being uploaded to a central cloud, along with people whose devices were (temporarily) disconnected from the internet after which they would no longer record.

The category 'Being smart' is one that manifested in many ways. Ranging across seventeen different subcategories, 'being smart' ultimately comes down to a need for the RVD to see and understand the world the same way humans do. To illustrate this, many people reported delivery drivers and visitors ignoring the video doorbell and knocking instead of ringing. The RVD registering knocking and proceeding to ring anyway would be a good example of how a smart doorbell could counter such occurrences. The smartness need also correlates with the 'No unnecessary disturbances' category. The RVD recognising residents and neighbours, thus realising sending a notification is probably redundant, or automatic switching between modes more suitable for the time of day are examples of improvements which could massively enhance user experience. Among others, knowing someone fell (either for funny footage or looking after elderly family members), monitoring weather, intercom, distinguishing animals and even recognising gunshots are examples of subcategories which fall within the realm of 'being smart'.

Another remarkable need is the desire to look good on camera. Many users claimed to be less than impressed by the way they look on RVD footage, with the RVD making users look fat or ugly. This is presumably mainly due to the widened fisheye/peephole-style distorted footage – anyone who has seen a 1990's Busta Rhymes music video will get the picture – the RVD provides to maximise range. While it is doubtful that many users will want to compromise on camera range just to look better on videos of them entering and leaving their front door, it may be the case that for some people it is of utmost importance to look good on camera. It certainly is something many users felt the urge to post on Twitter about.

Battery related needs range from battery life to charging time and notifications regarding battery status.

The final overarching need category is 'Feeling safe'. This category features micro blogs where a need for peace of mind was expressed or users reported suffering from doorbell anxiety. It is difficult to determine the true C/C ratio for this need, because cybersecurity or privacy concerns as well as frequent (late-night) notifications in some tweets have seemingly made users more nervous or paranoid. However, these effects did not translate into the relatively little featured 'Need for safety' category, thus making this category unreliable in the context of the ACC method.

In some cases need categories can contradict each other. An example of this is people wanting the RVD to register foxes or hares, but demanding low sensitivity in other cases. Personification and customisability seems key for the RVD.

5.1.3 Placement of Need Categories in Kano Model

Based on the complaint/compliment ratio we can place the need categories in the Kano model (figure 3).

Figure 3. Identified need categories in Kano model

It becomes apparent that applying the ACC method to RVD Twitter data leads to most need categories being classified as a 'must have'. One explanation for this could be that all micro-blogs are unsolicited and therefore certain features (e.g. the absence of local storage) may be a trigger for some customers to tweet negatively about the product, while customers who do not care about this would seldomly post an unsolicited compliment.

5.2 Usefulness of BERT Model

The algorithm's accuracy of 0.9173 appears promising and is higher than that of any of the 29 predictive methods applied to e-mobility in Kühl et al. (2016), where the best performing method achieved an accuracy of 0.8527. Then again, theoretically a model always predicting 'no need' would also have a high accuracy as most tweets do not contain needs. This shows that accuracy alone is not a very meaningful indicator. A precision of 0.493 and recall of 0.3715 is certainly reasonable compared to models used in Kühl et al. (2016). Although there are several models that either have higher precision or recall, no model scores higher in both departments at the same time. When comparing F_1 scores, only two models score slightly higher than the BERT model. However, these methods achieve lower accuracy. For both $F_{0.5}$ and F_2 there are seven methods used in Kühl et al. (2016) that achieve higher scores, though never the same ones and always with lower accuracy. It is fair to say that when one's objective is to find a well-balanced method for finding need tweets the BERT model suffices. It is also fair to say that applying said model to the RVD makes sense and provides meaningful results. However, one would have to accept missing out on 62% of need tweets and not finding needs in about half of the tweets considered to contain a need by the algorithm. The algorithm outperforms a random guess on every aspect except recall, meaning it would make sense to use it for anyone looking for RVD need tweets who has not yet looked at every single suggestion by the algorithm (i.e., the algorithm will always provide you with higher odds of finding a need tweet than a random tweet containing the same keywords).

5.3 Limitations

Although the Needmining method provides meaningful insights, it is not perfect. The algorithm does not provide a perfect prediction, and data training is arbitrary and may as a consequence be inconsistent. Furthermore, there may be tweets that are about the RVD that are not uncovered through the application of the keywords. On the contrary, not every tweet in the database is about the RVD, although irrelevant tweets are

relatively uncommon within the dataset. Additionally, the scope of this thesis is limited to the BERT model and the RVD. Little can be said about the model´s performance in other (tech) products, and a differently tuned model may have achieved better recall or precision, as well as $F_{0.5}$ and F_2 scores. These scores may be important for a researcher not wanting to overlook any needs, or researchers preferring efficiency and not wanting to do further filtering after the algorithm is applied. Ultimately, the algorithm may have performed more consistently for common need categories, and may have overlooked rare ones. This thesis does not distinguish performance levels between categories and only the overall performance of the algorithm is analysed in-depth. Furthermore, the algorithm does not automatically categorise need tweets, making it relatively inefficient.

In using the ACC method, it appears the limitation of reliability described by Mikulic and Prebezac (2011) is not truly overcome, as a dataset of 875 need tweets cannot really be considered big data. The reliability issue increases with smaller need categories as certain need categories may be misrepresented due to more vocal complaints. Furthermore, complaints and compliments in tweets do not reflect overall satisfaction with the product in most cases, which makes the impact on customer satisfaction of an attribute quite unclear. The fact that Twitter micro blogs are unsolicited means they are relatively genuine, but also incomplete. Ultimately, labelling complaints and compliments manually may have led to inconsistency and inaccuracy as determining sentiment is arbitrary.

5.4 Conclusion

Analysing Twitter data is a viable way of uncovering customer needs for the RVD. A relatively large number of needs can be found by monitoring tweets, as well as useful suggestions from users or potential buyers. One could come up with multiple innovation ideas provided the insights from need tweets, from both common patterns within need categories and stand-alone suggestions.

Applying the Needmining method through the BERT model is an effective and efficient means of filtering out noise in a large dataset of RVD related tweets. Now that the algorithm has been trained it can be applied on new Twitter information which will continue to come in every day. This means needs can be reviewed in real-time, which may be particularly useful shortly after the launch of a new version of the RVD. Although the algorithm cannot provide a dataset strictly consisting of customer needs, nor a dataset where every single need tweet prevails (while still filtering out noise), applying it does make it a lot easier to determine needs from a dataset of RVD related tweets.

The ACC method provides insights about the sentiment towards need categories. It is unreliable in small categories and incomplete as overall satisfaction cannot be determined. However, large categories can be placed within the model more reliably, which adds to the understanding of the managerial implications of those customer need categories.

Further research needs to be done to expand on the scope of the Needmining method and to automatically distinguish need categories.

6. ACKNOWLEDGEMENTS

Special thanks to dr. Dorian Proksch for providing supervision, guidance and feedback throughout the creation of this thesis. Also thanks to my fellow students Justus Jürgens, Joel Tyhaar and Eric Wan for peer reviewing and discussing my work throughout its creation. I would like to thank my study advisor Lena Ay for guiding me through my Bachelor program and keeping my spirits up on multiple occasions.

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8. APPENDIX

my dad keeps alluding to wanting to get a camera doorbell and it's like I don't know how to tell u I don't want any kind of surveillance near my house and if anyone was outside in the first place I would really appreciate keeping my blissful ignorance intact

@ring I got rid of all my Ring devices after hearing @ring wants to give my videos to the police. I HIGHLY question if it's just the doorbell videos, and not also peeping in on my indoor Ring camera. The same way Alexa supposedly listens to family conversations.

@flexlibris are any of the video doorbell companies not giving police full access? Like if I got an Arlo will the police potentially have access to my info or is this mostly a Ring thing?

Are there any video doorbell gadgets that don't have bad/questionable data privacy policies?I mean'you have control over video collected, they don't have permission to do whatever with it/share with outside orgsbasically anti-surveillance surveillance #infosec #dataprivacy

I'd like to get video doorbell and some smart t-stats (probably Nest), but I don't trust Google or Amazon to not be spying on me or to somehow, someday use this data against me (maybe in cahoots with a corrupt federal gov't like the one we have now). Am I overly paranoid? Advice?

I'm uneasy with @Ring 's and @Amazon 's disregard for my #privacy and want to stop using their products. BUT, I do love the features of a smart doorbell and would like to incorporate other exterior cameras/flood lights. Do products exist that respect their customers' privacy?

@BestBuy I'm going to pass on a product that spies on me to use my information and calls it security. There's actually secure security cameras available that I'd trust before ever considering a Ring camera.

Appendix A: Tweets from need subcategory 'Privacy from outsiders'

My parents ring camera just cought me shotgunning two twisted teas and then puking in the fron yard. By myself. Thats going to be a fun conversation tomorrow morning.
My sister is really deleting footage off of our ring camera so I don't realize that she's bringing her ex boyfriend back into the house?
HELPP MY LITTLE SISTER HAD HER FIRST KISS ON THE RING CAMERA STOP THATS SO EMBARRASSING FOR HER
How the fuck am I meant to disguise the amount of deliveries I have a week now that Nathan has decided to have a camera doorbell! To mums it is ?
Y'all wanna know something annoying? My dad installed a camera doorbell and literally EVERY TIME we step out he calls and is like 'Where are you going?' Even if it's just going to pick up the mail.
Bro my papa got me on the fuckin ring camera sneakin and geekin last night ?
I literally can't be in the front yard without my mom trying to talk to my through the ring (camera) ? she's so annoying! ?
Broooooo we forgot the ring camera was on and just talking about stupid shit ? I'm so dead right now
Ever since my parents got their ring camera I don't even bother to tell them what time I got home I know they saw my ass get home at 3:47:28 am
You wanna know what I hate ... COMING HOME FROM THE NIGHT BEFORE and my dad seeing me all thrashed walking in from the damn ring camera .

Appendix B: Tweets from need subcategory 'Privacy from family members'

Installed a Ring camera today. Think I'm going to have a stress-endured anyuerism from all of the updates and notifications it's sending me.
This lizard keeps climbing on my ring camera in the front so I keep getting motion alerts. I'm bouta smoke his lil ass
@ring_uk @cdf2020 Sadly, we have the same experience. Very disappointed in our Ring video doorbell pro. We were considering extending the Ring products ie security, etc. Not now, the doorbell is soooo temperamental ?
@Mon_de_mon_star During this quarantine I planted two catnip plants in the front beds, and now according my ring camera there is a party out front every night. At first the #latenight motion notifications were alarming, but last night I almost poured a whiskey and joined them. #QuarentineLife
My damn Ring camera so sensitive. It picks up every motion outside.
If this @ring camera picks up another insect and sounds an alert, I'm taking it out with a baseball bat! It's only supposed to detect people! It's 2AM, I really need to sleep!
Neighborhood cats keeps setting off my #ring camera.
My Ring camera system gives me so many false alarms I don't even check it anymore. ? Ok now back to #Gears5
Wind must be howling at my house that ring camera goin crazy
Idk if there's a ghost outside our front door or what. I keep getting alerts from the ring camera that there's motion outside and when I go look..... nothing there. ?

Appendix C: Tweets from need subcategory 'No unnecessary disturbance'

Our completely worthless @Ring camera completely missed someone stealing something right off our front lawn. One minute it's there, the next minute, gone... no motion detected, nothing recorded. But it's happy to record every skunk and raccoon that happens by. Utter garbage.
Someone broke into my moms and my cars last night and didn't take anything ? but went thru all our shit and it's the one night our ring camera don't wanna work ! what the fuck ?
Someone stole my dads truck yesterday morning beside my mom not noticing she went to check her @ring camera and that crap didn't catch anything.. only the truck there then five mins later gone ? laughing my ass of great security camera!
Me: ah I feel like my childhood paranormal ability/insight has faded in adulthood.Ring camera upstairs that suddenly alerts motion with no one and no cats on the same floor as it: no worries girl, got you! ?
@BestBuy The Ring audio/video doorbell hasn't worked properly since the day we installed it, even with hours spent on the phone with their techs. I definitely wouldn't recommend it.?
@ring Just set up my new video doorbell 2 and it doesn't detect motion until someone is already at the fro t door. I have the motion set for 15-30 feet but it doesn't work at all. Help!
my Ring camera alerts me when every car drives by but when a person is standing on my porch it is suddenly blind
returning my amazon ring camera because it called the police on my diaper delivery guy for delivering too many diapers ?

Appendix D: Tweets from need subcategory 'Reliability'

I'm gonna need this snow to stop because it keeps telling my ring camera there's motion at my front door lol
My ring camera so shitty in the rain
@ringviddoorbell I am very disappointed in your video doorbell products. I live in Michigan and the weather gets cold so we travel. Every time we do, our doorbells lose power even though they are plugged in and they stop working. Seems like you could come up with a better design!
Gang. Looking to get one of them fancy video doorbells. They all say good up to -15c (LOL). What's a #yeg compatible video doorbell that you use that will survive the deepest of February's frozen hell? Thanks.
@MnBachtle @WCCO Not true for my Ring camera worked fine at -24 on battery
My video doorbell manages to catch my asshole dogs 60k times a day, but fails to catch me get my car, drive 300yds down the driveway and back to meet UPS cus it's "too snowy" apparently, and then come back and unload a carload of packages they delivered. I have 0 faith in you, Ring.
@PhotonEmpress I'd love a video doorbell. Just need one that can handle 122' ambient plus full sun in the afternoon.
@DetroitBORG Looking to get a smart doorbell for the family this Black Friday. We live in a part of the country that temperatures have dipped down to -15 before (though not constant). Do you have any recommendations for what would be best with these condition?

Appendix E: Tweets from need subcategory 'Performance under all weather conditions'

My smart doorbell: Hey! Someone's at your door!Me: Okay. Opens appMSD: We logged you out. Log back in pleaseMe: Tries three passwords, logs inMSD: We're gonna send a codeMe: Waits for code. Gets code. Enters it inMSD: Oh lol, they left. Wanna see the video? *Loading*
@ring ... what's the point of having a video doorbell if it's so slow that you can't actually talk to the person at your door? obviously connectivity isn't an issue, since I got the notification that the button was pushed #fail 2/2
Ring video doorbell is exactly laggy enough to never be faster than going to the door if I'm actually at home.
@danbixby @googlenest Also looking for a video doorbell that does onvif too because I'm hating Ring at this point, laggy response times and weird missed/delayed notifications.
Just replaced my "smart" doorbell with a "stupid" one. Same set of features but with a latency of milliseconds instead of several seconds: can survive power surges: survives deauth Wi-Fi attacks... Less is more ?
We decided to swap out our Ring doorbell for a @eufyvideo doorbell and really like it. The eufy doorbell is so much faster to view and the picture notifications they send to your phone are perfect. Just wish the doorbell press could activate the live view on our echo show though
Don't waste money on a ring camera system because that shit is so damn slow when trying to pull up the camera. I'd already be dead by the time It pulls up
My ring camera is ass smh how am I supposed to see who's here if that shit takes forever to load ? this is why I use the other cameras smh

Appendix F: Tweets from need subcategory 'Quickness'

@InternetofHomes @Apple @amazon @Google I'm leaning toward Google because of how intelligent Assistant is beyond basics requests. However I love the simplicity Apple offers w Homekit. I need a smart doorbell so I'm having to make this exact decision. Would love to hear other opinions on this tough choice! #iot #smarthome
@CoveSmart are there any video doorbell brands that work seemlessly with CoveSmart?
@HudsonPeralta We have the Ring video doorbell 3. I wish they provided native support, but homebridge seems solid enough.
@CioaraJeremy @cfzellers4 I'm a big fan, it replaced a ring video doorbell.. no subscription, integrates seamlessly with my home automation solution @home_assistant and unifi protect.. the camera and front facing display are also awesome!
@AndreaLynnLewis I have Alexa devices, they integrate with my TV, smart doorbell and Hue lights. They're all minor improvements in convenience but I think they are worth it personally. I understand they anonymise the data they collect, but try not to worry about it.
Did I screw up' I have a @googlenest Google Home Hub (that has the screen) and just installed a @ring Video Doorbell 2. It doesn't seem that I can add the Ring to Google Home: 'Ring' is not listed in the devices I can add. But I've read articles saying you can. Support dropped?
@danbridgland Hi Dan, Ring Video Doorbell (Gen 2) can be paired with your Ring Alarm base station to expand your Ring of Security. At this time, Ring Video Doorbell (Gen 2) does not work with other smart home hubs.

Appendix G: Tweets from need subcategory 'Compatibility'

and now i just ordered my Nest video doorbell ? only because my RING is too big so i needed something slimmer. plus $149 is a steal! Thanks @Target
At this point I'm just going to physically go into a store and get what I need. I refuse to order online. These delivery companies claiming to attempt a delivery lie. Everyone freezes up when they find out I have a ring camera like who ya foolin -.-
@tarungangwani The main pain point I have with smart doorbells is how big they are compared to an old fashioned doorbell button. My house has only a small piece of trim that holds the button, and no smart doorbell will fit there ?
FYI: a video doorbell can be defeated by a thief who knows where it is by approaching doorbell from the side and using tape, spray-paint, etc. Use unreachable or inconspicuous cameras.
@Hernandez7 I have a video doorbell pro from ring and I really like it. I think it has a good aesthetic in comparison to nest. I can't speak toward the user interface though as I haven't used nest. I'm sure they are both pretty good though.
When you overdesign your smart doorbell into a shiny black obelisk with blue laser beams around perimeter, it doesn't look like a doorbell anymore. No normal human is going to press it. You've made a useless doorbell.
(that said, we have a ring camera, and i'm always afraid of dropping that security screw when I change the battery, they should've made it captive)
@ring Bought a Ring camera for the front door in August and I can't take the screws out to charge it! I've been reading and it looks like it happened to a lot of customers! Please help!
@ring I've had my ring video doorbell since 2017 and it has stopped working and the doorbell button has become really sharp. Do I just throw it away and start again?

Appendix H: Tweets from need category 'Design'

I wish I had a #Ring camera just so I can capture the lightning when it storms (and to be nosy in my neighborhood).
@CM2k100 BUT the ring camera indoors can't see through the glass doors at night, but I'm not spending another '200 on another outdoor one.
@shakuky22 I know I've been debating on getting a ring camera they capture a wide space!
@DjE_lectrik10 They bold as hell to nigga knock like the ring camera don't see em ?
@OttawaCitizen That's a perfect photo, good job Ring camera / doorbell.
@ring how can a (@foxandfriends)Stranger caught pooping in Florida driveway by Ring camera be pixelated in broad day light that cops can't even identify the man on camera? But @Fancymcgriddles has a perfectly looking Dobby walking at night? Upgrade your system for quality purpose
Why is the depth of field on my @ring video doorbell so shallow? Only things within a few feet of the unit are in focus. Nothing further away has any detail at all. Also, the exposure of the area beyond my porch is awful. Completely over exposed.
I finally got a Ring camera and wow it is so clear and gorgeous resolution, guess what it's gonna be used for?! ...kitten season ? I want to be able to monitor the progress of mama cat's labor and delivery without disturbing her!
This ring camera is so cool. The quality is actually pretty good!

Appendix I: Tweets from need category 'Camera quality'

Sister's dog has learned the 'Ring Doorbell' sound means 'someone is at the door: bark and protect'. This morning the radio is playing an advert each break for' Ring Video Doorbell, with the RVD sound twice. Dog doesn't know the difference! ?
@jayette That's one nice feature of smart doorbell. I can turn off the ringer. Dogs don't react to Google stating, "There's someone at the door."
Fortunately for Kerri it looks like our smart doorbell doesn't let you upload a custom file of Matt Besser yelling 'awwwooo Wolfman Jack says someone's at the front door, baby'
Don't have a smart doorbell, a dog, and a TV that plays adverts for your smart doorbell brand if you don't want a long argument with the dog about there being no one at the door
Is my dog the only one with Ring Camera PTSD? She hears it on a commercial and be flying to the door ?
I don't know how this happened, but my dog knows the sound my phone makes when the ring camera detects motion. I keep changing the sounds to confuse him, but he keeps catching on. I'm even more confused because I usually just check my phone rather than looking outside. ?
@ring I want to change the sound of the chime paired to my Video Doorbell 2. If that is possible, how to do it?
@ring HI, my video doorbell Ring does not have the chime tones as a couple of months ago? Why did this changed and how can I get back the Christmas tone?.
Q. Can I make my smart doorbell play Ding dang ding, bing bang bong when I have visitors? Asking for a friend.

Appendix J: Tweets from need category 'Adjustability'

@Snack8671 Every digital device in our homes is capable of being compromised."Everybody loves a video doorbell"Especially burglers who can tell when you aren't home.And with the cameras all through the house they can case the INSIDE of yer hse for their "shopping" spree.
ever since i seen that ring camera get hacked i'm creeped out by house cameras
i don't get how tv is still promoting that ring camera when there's so many people complaining they're getting hacked.
@CouponCollect0r Just google ring camera hacking and there's like tons of stories
RT @josephfcox: New: the Ring camera hacking is worse than previously known. We gained access to a Discord server where the hackers livestr'
My worst nightmare:' Ring security camera hacks see homeowners subjected to racial abuse, ransom demands - ABC News - ring-camera-hacks-demand-ransom-racial-abuse via @ABC
Reading about all these 'ring' camera backings and I'm like what the fuck . That is soooo creepy ?
So the #ring #camera isn't safe after all. Hacked by psychos peering in at your family. #ridiculous
I have seen 4(!) different videos of a @ring camera being hacked. That's no coincidence, there's obviously something wrong or off with their system. Thankfully I don't have one (shout-out to @WyzeCam), but my parents do and my child goes over there. So not cool, Ring.
Title: Amazon Ring went from a smart doorbell company to a surveillance network?: Well, that was awesome. How would they protect their customers from this from the attack? If there was a

Appendix K: Tweets from need category 'Cybersecurity'

I'm dogsitting for my aunt and uncle and I'm sitting here listening to the entire family talking to the dogs through the Ring camera outside ?
I set out snacks and drinks for delivery drivers on our porch and I've noticed a lot missing? Checked the ring camera and squirrels have stolen it, opened it and left remnants around the front yard. My husband just saw a squirrel in a tree with an entire Belvita Breakfast cookie
i wanna get a ring camera thingy just so i can see what my cats do all day?
@foxguardiansuk I live in the middle of the city (Omaha, Nebraska) and saw my first fox on my ring camera early this morning. Normally, I would be thrilled but I have chickens. Is there something I can do to keep the fox from my yard and chickens?
I convinced my spouse we needed more 'security' but mostly I wanted a video doorbell on our backdoor so I could watch live streams of our dogs all day.
I'm talking to my cat Thru the ring camera on my lunch break ?
Just put a Ring camera up outside my front door. How long do I have to wait to capture a heartwarming video of a dog and his raccoon pal, or similar?
@MelvaDeshmukh But I just love being able to see animals you don't know they're being videotaped acting completely natural. J's parents got a bear a couple times with their new Ring camera.
My stepmom got a smart doorbell so she can talk to her dogs LMAO
I can't wait to hook up my ring camera so I can watch what my dogs do when I'm not home ?
Can't stop watching my cat on the ring camera in the garden. Addicted.

Appendix L: Tweets from need category 'Detecting/interacting with animals'

@ring do you have a support phone line in the UK ? My video doorbell keeps going offline and I need to speak to someone to get some support
@ring 2nd gen video doorbell not working. Hard wired for power. Support is bad for consumers if you ask me. Do hard wired video doorbell batteries charge from the existing door bell power? Need help because the doorbell just stop working and isn't there a 1 year warranty?
@JamieSiminoff I had a few interactions with @ring customer service regarding some issues with the video doorbell. I have to say that the response was appalling, very unhelpful, unprofessional staff, disconnects the line and never calls back! I've lost my money and faith on #Ring
@allenmcnulty @ScottCStanek1 I just got a Ring home security system. It was really easy to install and customer service was quite helpful.You can get a wired and non wired video doorbell. Give them a call and they'll talk you through it. I'll be getting two eventually - for my front and side doors.
@ring I think it's ridiculous that I paid for a Ring Video doorbell Pro 2 that doesn't work correctly and your customer service couldn't overnight me a replacement. I have to wait a week with a defective unit and an unsecured yard. I don't recall making you wait for your $250.
I've had a video doorbell for a few years and am very happy with it, I had a small problem however and the customer service team @ring have been fantastic and gone beyond my
d1 ⊕

Appendix M: Tweets from need subcategory 'Customer support'

I need someone to wire my video doorbell for me. I was putting it off until I can do it myself (when I have two working legs again) but the panic that happens when someone knocks on the door is unsustainable. Is that.. an electrician? A general contractor? Someone else?
i have to set up the Ring video doorbell i got for my parents and i have to mess with the wires i'm so scared AAAAA i hate hardware if i die you know which company to sue
I've been trying to set up this Ring camera for daysss!
Where I wanted my Ring camera was too hard for me to install because my drill wasn't strong enough so I posted on the Nextdoor neighbor app and allllll these people recommended me technicians etc
If you have a #Ring camera/doorbell etc then don't ever lose access to the set up email. It will cause you untold grief and, it seems no one at Ring or #Amazon is capable of sorting the problem. Anyone want an expensive ornament?
@ring why don't any of your customer service representatives know how to answer questions about the Ring Video Doorbell Pro?! 3 hours into trouble shooting and were no where closer to any sort of resolution. RIDICULOUS!
what type of handy person do I need to hire to install a video doorbell?
So, got a @ring video doorbell pro. The 20 minute install may be an underestimation if you figure in the time it takes for tech support. Try one week. So far? ?
You know you have nothing to do when setting up your Ring camera consumes 6 hrs of your day because you can't get it to work ? #Stillnotworking #StayAtHome

Appendix N: Tweets from need subcategory 'Installation service'

@SDF_of_BC @GeoCyberwolf @ring imo, it should be LAN only. you only ever connect a device to the outside world if its needed, i.e. a camera doorbell. and that should also still function locally. that or updates ofc. i like the idea but its far too expensive, and the "features" are too limiting.
I just checked RING camera dies, not still working if internet down. Dis sum bullshit.
When my ring camera disconnects from my WiFi I freak out thinking someone's going to come and kill me and the ring isn't even working
The second @ubnt bring out their smart doorbell our @ring doorbell is (responsibly) going in the trash. Battery notifications only if you opt into marketing, local mode is there but they take away audio features if you try to force it.
I want a smart doorbell but I don't want to pay a monthly fee... Can't I have the door bell store locally or on cloud storage that I already have?Hey @google I pay you for play music, I have a Pixel 3 XL, I have Google WiFi and several Google home devices... Gimme a break.
@devxvda @frlinux We had an original Ring camera. I didn't like who got access to the cloud videos. I like this because the storage of the videos is local, yet still available to stream it do your smart device. The video quality is great, and it's fast to respond to visitors.
@ring every time I have a power cut I have to set up my camera, doorbell and chime from scratch. Is there a better way? Currently thinking it's easier to just decommission and cancel my subscription.

Appendix O: Tweets from need category 'Local storage'

Some days I'm glad I paid over '100 for a camera doorbell, just so no fucker can use it ?. Thanks for knocking and then leaving a card to say attempted delivery.
@PurolatorHelp Your driver almost broke my door down today knocking so hard. I open the door and ask him why he's banging so hard and he shrugs his shoulders. We have a very visible video doorbell which he could have easily pressed.
I spent a lot of money on a video doorbell for people to still knock on the door. Ffs.
Dear @dpd_support have your drivers ever had the concept of a ring video doorbell explained to them? I keep missing parcels because they knock on my door either side of the video bell.
@UPSHelp Someone who has a video doorbell does so that they don't miss deliveries. Why then would a driver choose to knock? That's silly. Any owner of a ring doorbell will have their phone with them. I can't hear my door being knocked but I can feel my phone vibrate with a message
Either people don't know how to use it, or they don't want to push the button on a video door bell, but we seem to be back to door knocking. Anybody experience this with their video door bells? It sorta defeats the convenience of the video doorbell.
Ever since my family got the Ring camera every body wants to knock on the door now no one wants to be recorded lol
WHY do people still bang on your door when you have a video doorbell.

Appendix P: Tweets from need subcategory 'Ringing when someone knocks'

I hate that I have a Ring camera sometimes. ? I really hate my neighbors! I'm not telling nobody how to live, but bro... it's a one bed room .... it's a couple and 3-4 kids.... AND WHEN I SAY PEOPLE RUN IN AND OUT THAT APT IN PACKS..... I just'
Trying not to be offended that our smart doorbell tags most of our male, middle-aged delivery drivers as me. ?
@Alohababe2011 My camera doorbell doesn't recognize me. ?
If my neighbors could stop having work done to their house so our Ring camera would stop alerting me every single time they walk to their work truck, that'd be nice.
I really wish my @ring camera could recognize me and family members and not alert when we walk in/out the door! Handy to have the recording, just weird when all of our phones alert us!
I was working outside and I got a Ring camera notification on my watch. I ran inside to get my phone to see who it was. It was me. ?
Everday my Ring camera is like 'there's a person in your backyard!'it's me
Sooo...I looked at my Ring camera and thought I had a burglar on my porch earlier in the day. Only to realize... it was just me with the extra #quarantineweight?
Ever since getting a Ring video doorbell it has been a non stop 'who the fuck is that fat bast..oh, thats me. That fat bastard is me.'
I don't leave the house so I'm turning off notifications for my Ring camera. ITS ME. EVERY FUCKIN TIME

Appendix Q: Tweets from need subcategory 'Recognising familiar people'

@ring If you currently have a Ring Camera on a motion schedule, but want to use Modes so if you leave, you can tap 'Away' mode and have that motion schedule override? It seems to keep using the motion schedule in both Home and Away modes. I need a way to keep the schedule or bypass
Children take naps at set times. Adults also sleep during the day at set times and cannot afford to be disturbed. I don't want to manually turn the doorbell off and on every single day for the rest of our life when this is a SMART DOORBELL and it should do it automatically.
You know when having a Ring camera and motion detector on your front door sucks? Halloween.....notifications like crazy.
Installed a fancy camera doorbell today. Hoping that I can maybe make it slightly less sensitive. But, wow. This should fend off any potential package thieves... Or In-laws. Hahaha
Anybody know how to program a Ring camera to only track animals?
@ring Since the update of the ring video doorbell app, I no longer see a setting to turn off motion detection. Could you tell me how I do this? I have got the first version of the Ring video doorbell with a battery. Thanks for your reply.
Any Ring camera users know if there is anyway to schedule modes? #ring #ringcamera #schedule #automate

Appendix R: Tweets from need subcategory 'Automated switching between modes'

aye bro what the fuck just watched myself walking away from my ring camera and i'm literally a fucking fridge like the shorts and boxy crop top do not do me justice but got damn, am i gonna change the way i dress to flatter me tho? no ?
What the RING video-doorbell company doesn't advertise is how often you'll capture yourself on camera unflatteringly walking up your porch stairs in 100+ degree heat index
I look big as shit from behind on my ring camera ?
Ummmzzz... looking at myself on the ring camera was a mistake
I do be looking a Lil thick when I check my ring camera, so there's one good thing haha
no one talk to me i just saw what i looked like on the ring camera
if you know me in real life do i stand funny or is my ring camera just very very humbling
You just don't know how unappealing your body shape is until you see yourself on the ring camera ?
I look good as fuck on the ring camera I'm about to have a lil foto shoot
Our Ring camera is giving me bad self esteem. ?
Seeing my face on the ring camera is actually worse than the target self checkout cam. ?
We talk about how ugly we be on the checkout cameras but my ring camera is literally the worst. I hate this hoe lmfao
A video doorbell is great for keeping you humble, you leave the house feeling like yeah I look OK today, my hair's gone right, I feel confident - then you get an alert on your phone with a wide angle video of your serious door locking face, brings you right back down to reality
My ring camera always makes me look so skinny ?

Appendix S: Tweets from need category 'Flattering footage of user'

Ring camera batteries charge soooooo slow. Who uses micro usb anymore?
@petersagal I have two Ring Video Doorbell. They work great. One is hard wired in and one runs on battery. Battery life is awesome. 4 months between charges.
@ring I have a 2020 Ring Video Doorbell that's hardwired and still somehow got down to 3% battery with no warning. It doesn't charge when I plug in usb...does it have to be disconnected from doorbell wires in order to charge? Very disappointed.
So we ordered a Ring video doorbell 2 at the end of July. It was installed around the first of August. Only had to recharge the battery today. It's on motion detection, not live view but almost 4 full months on battery isn't bad.
@ring I got me a ring video doorbell in 2017 and last summer I got me a solar charger but still after charging the doorbell the battery goes low within three days and needs to be recharged. I live in the Nerherlands in Amsterdam. Please tell me what I can do to solve this.
@DuckDuckGo @mguariglia I love my ring camera but...went almost a year without having to charge it, now I have to every 3 weeks!
This ring video doorbell been charging for hours. ?
Although from a personal perspective, I'd be delighted if I could get my video doorbell battery to last for more than about 5 days! Grrrr.
@tehemopenguin @ring I have the ring video doorbell 3 and have never been disappointed. It only needs charged like 1 night every month or two

Appendix T: Tweets from need category ‘Battery quality’

@TIA_EWING I love my Ring camera. I have one on my front and back doors and gives me so much peace of mind. I like the neighborhood feature where you can see videos shared by others in your area. It's good to know if people are stealing packages or randomly knocking on doors.
embracing the surveillance state by moving into a new apartment with a "smart" doorbell
I love getting text and video footage alerts of crime in my local area thanks to the Ring Video Doorbell ? If there's a crime, then it alerts everyone on the Ring social network w/ the footage along w/ the location of the crime so that you can help to locate/identify the criminal
so some kids were doing mischief down the road. cops knock on our door after seeing we have a video doorbell We look back at the footage and see the kids running across our front lawn and shared the video with the police.Not all tech is bad techwhat a time to be alive
Grateful to have a video doorbell so now when I leave my house for a couple of days or more, every waking hour when I think it probably burned down for no reason, I can make sure it hasn't.
@hjbowman98 But the camera doorbell makes me feel safe
I installed a @ring camera at my Nan's house yesterday to keep an eye on her as she keeps falling over. We have named the camera "NanTV" ?
Does anyone use a video doorbell system? I would like honest opinions about them. Im curious if 1 can help me keep an eye on the house and my mom when Im away #Alzheimers@JenniferHorsle3 @ronferris7 @JamesCraigmyle @FeliciaHardcas2 @ChristieCarr918 @Amy_ShihTzu3 @NSPTrooperCook
@JJ49E Which area do you live mate? Have you thought of cameras? I have them. I got them as I work nights and it allows me to check on the house to make sure my wife and son are OK. Have a think about a video doorbell. I know a bit about both these so if you need any advice let me know!
@PAlife3 The video doorbell is totally worth it. I have severe doorbell anxiety and it helped a ton!

Appendix U: Tweets from need category ‘Feeling safe’