

Time series analysis of ITV news bulletins

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Abstract

We analyze shot length data from the three main daily news bulletins broadcast on ITV 1 from 8 August 2011 to 12 August 2011, inclusive. In particular, we are interested to compare the distribution of shot lengths of bulletins broadcast on different days and at different times across this time period, and to examine the time series structure by identifying clusters of shots of shorter and longer duration in order to understand the relationship between this aspect of the formal structure to the discourse structure of these broadcasts. The discourse structure of the bulletins in this sample is fixed, and remains constant irrespective of the subject of news items themselves suggesting that content is adapted to meet the needs of this structure. The statistical results show that neither the day nor the time of broadcast has any impact on the distribution of shot lengths, and the editing style is consistent across the whole sample. There is no common pattern to the time series of these bulletins, but there are some consistent features in the time series for these bulletins: clusters of longer takes are associated with static shots of people talking on screen, while clusters of shorter takes occur with montage sequences, sports reports, series of news items, and footage from non-ITN sources. Consequently, the presence and order of discourse elements in a bulletin shapes its formal structure.

Keywords: Time series analysis, film style, editing, news, ITV

1. Introduction

The organization of a television news bulletin can be analyzed in two ways. First, we can study its discourse structure – the sequence in which the various elements that constitute the text are presented and the system of coherence relations that hold between those elements (Bärenfänger *et al.* 2010: 82). Television news bulletins are a highly structured form of discourse that evolve according to a predictable pattern due to the strong constraints that govern the presence of a limited set of structural elements and the order in which they occur; and this dimension of television news has been extensively studied and is generally well understood (van Dijk 1988; Choi & Lee 2006; Montgomery 2007; Tan 2011). A second approach is to look at a bulletin's formal structure – the arrangement of its constitutive stylistic elements, such as mise-en-scene, framing, editing, sound, etc. (Carroll 1998). The visual style of television news bulletins and television news documentaries (Grabe *et al.* 2001, Schaefer 1997, Schaefer & Martinez 2009) have been studied, but there is a lack of detailed research into the form of visual news media. Schaefer and Martinez (2009) note the dearth of formal analyses of television news broadcasts, which they attribute to 'the lack of a conventional vocabulary for describing and analyzing structural techniques used in what is primarily an audio-visual phenomenon' and a reliance on 'scant anecdotal evidence.' The lack of such a suitable vocabulary among media researchers is astonishing given the attention devoted to understanding how style affects the cognitive and emotional responses of the viewer in film studies, but perhaps unsurprising when the elements of film form are not treated as important as content but are referred to as nothing more than the 'immaterial bells and whistles' of television programmes (Grabe *et al.* 2001).

Given the lack of research of the formal structure of television news it is unsurprising that the relationship between the discourse and formal structure of television news has been also overlooked.¹ This paper analyzes the main ITV 1 news bulletins broadcast from 8 August 2011 to 12 August 2011, inclusive, in order to relate the discourse structure of a bulletin to one aspect of its formal structure: the distribution of the shot lengths of a bulletin. Specifically, I address three questions: (1) does the distribution of shot lengths in a bulletin vary with its day and/or time of broadcast; (2) is there a dynamic relationship between the discourse structure and formal structure over the running time of a bulletin; and, (3) are clusters of longer or shorter shots associated with particular elements of the discourse structure of a bulletin? The rest of the paper is organised as follows: the next section describes the sample used in the study and the statistical methods employed; section three describes the discourse structure of ITV 1 news bulletins; and section four presents the statistical results of the formal analysis and relates these to the structural elements that constitute each broadcast.

2. Data description and statistical methods

ITV is a commercial broadcaster in the UK, with one terrestrial/digital channel public service channel (ITV 1), and six digital-only portfolio channels (ITV 1+1, ITV 2, ITV2+1, ITV 3, ITV 4, and CITV) as of 21 September 2011.² As a public service broadcaster, ITV 1 is required to meet the requirements of high quality, impartial news programming at peak and other viewing times as set out in the Communications Act, 2003, and determined by the Office of the Communications Regulator (Ofcom). ITV 1 is obliged to provide 365 hours of national and international news per year, of which 125 hours are required to be broadcast during peak viewing hours, though in fact it exceeds these requirements.³ The main news provision during the week is provided by three bulletins at 1330, 1830 and 2200; and by three 15 minute bulletins per day at the weekend with no fixed time, but broadcast at lunchtime, early evening, and late-night. The place of the weekend bulletins in the schedule varies according to the presence of other types of programmes in the schedule, and so they are not included in the study. Morning news (pre-0830) is provided part of the channel 3 breakfast license as a series of short, headline-driven reports, and is also not included. News programmes on ITV 1 are provided by Independent Television News (ITN), which also provides news programming in the UK to Channel 4, and not directly by the broadcaster itself.

2.1 Sample

Shot length data was collected for the 1330, 1830, and 2200 bulletins broadcast on ITV 1 for the five day period beginning Monday 8 August 2011, giving a total of 15 datasets. All broadcasts were recorded at 50 Hz, and the shot length data was analyzed at 25 frames-per-second. The 1830 bulletins include a commercial break, but are treated as a single unbroken programme for the purposes of analysis.

¹ Bentele (1985) proposed a methodology for jointly analysing the discourse and formal dimensions of television programmes, but this does not appear to have produced any subsequent body of research linking discourse to form.

² From 2012, ITV will become a digital only broadcaster as the UK's analogue broadcast system is switched off. Portfolio channels are not subject to the same public service regulations as the main PSB channel (i.e. ITV 1).

³ Regional news and current affairs are subject to separate broadcast obligations under ITV 1's PSB license.

In this paper, a *shot* is defined as a continuous sequence of frames, and an *edit* is defined as any transition between two shots, such as a hard cut or a gradual transition (wipe, fade, dissolve, etc). When the edit is gradual, the ending of the first shot and the beginning of the second shot is measured at the approximate mid-way point of the transition. The display of graphics in news bulletins often includes the use of composite shots in which the frame is broken up into several sectors (e.g. split-screen shots) or which superimpose one piece of film onto another; and these are considered to be a single shot as there is no edit between the in-frame transitions although the image itself changes.

The news bulletins in this week were dominated by reports on the riots in London, Birmingham, and Manchester that erupted on Saturday 6 August, 2011, though it was not the goal of this study to specifically analyse news media on the subject of the riots. (An earlier attempt to collect a similar data set in July 2011 had to be abandoned due to a break in the transmission in one of the news bulletins that rendered the sample unusable). It is possible that the extent to which this topic came to dominate news bulletins during this week means that the sample analysed is unrepresentative of news bulletins on ITV 1. There is, however, no reason to believe that journalistic practices were altered specifically for this story and there is no other similar data set against which the one used in this study may be tested.

2.2 Shot length distributions

The distribution of shot lengths in a motion picture is typically positively skewed and includes a number of extreme shot lengths, and so the five-number summary is used to describe this data. Additionally, Q_n is used as a robust measure of dispersion based on the distance of each data point from every other and is estimated to be $Q_n = c_{Q_n} \times 2.2219 \times \{|X_i - X_j|; i < j\}_{(k)}$, where $k = 0.25$ to give the lower quartile of the absolute pairwise differences between shot lengths, and the factors c_{Q_n} and 2.2219 are for bias correction and consistency (Rousseeuw & Croux 1993).

In addition to the descriptive statistics, a 5×3 (day \times time) factorial analysis of variance without replication was conducted for both the median shot lengths and Q_n to determine if day of the week or time of broadcast were important factors in shaping the editing style of news bulletins.

2.3 Time series analysis: the running Mann-Whitney Z statistic

The Mann-Whitney U test is a nonparametric test of the null hypothesis of stochastic equality between two independent random variables (Mann & Whitney 1947); and involves combining the two samples, ranking the pooled data, and then calculating the statistic U as the number of times a data value from one sample is preceded by data values from the other sample. If one variable is stochastically superior then data values in this sample will tend to have higher ranks than the data values in the other sample – i.e. the samples will cluster at opposite ends of the pooled ranks. Mauget (2011) has proposed using the Mann-Whitney U test as a method for identifying the most significant high- and low-ranking regimes in time series data that is simple to implement, robust against outliers, and does not depend on assumptions about the distribution of the data. Crucially for the analysis of the evolution of style across a motion picture, it is required only that the order in which the data values occur is maintained and we need not be concerned that time is not an independent variable. Applying this method to the formal organization of a motion picture allows us to identify trends over the course of its running time, to identify clusters of takes of long or short duration, to identify the points at which the style changes, and to determine if any intermittent cyclical patterns are present. As it makes so few demands on the data, it is a method that can also be used as a part of exploratory data analysis to evaluate the

assumptions required for further time series analysis of the dynamic evolution of style in motion pictures.

The first step in the analysis is to rank the N shots in a motion picture, with the smallest x_i assigned rank 1 and the largest x_i assigned rank N . Shots of equal length are assigned the average of the ranks they would have been assigned if there were no ties: if x_2 and x_3 are observations with equal values, the average rank assigned to each is $\frac{2+3}{2} = 2.5$, and the next highest value will be assigned a rank of 4. The rankings are then sampled with a moving window of size n_1 , and converted to U statistics by

$$U = R_1 - \frac{n_1}{2}(n_1 + 1),$$

where R_1 is the sum of ranks in the window of size n_1 . When the sample size is large ($n_1 \geq 10$), the distribution of U is approximately normal with mean $\mu = (n_1 \times n_2)/2$, and standard deviation,

$$\sigma = \sqrt{\frac{n_1 n_2 (n_1 + n_2 + 1)}{12}},$$

where $n_2 = N - n_1$. Statistical significance can therefore be determined by calculating a Z statistic,

$$Z = \frac{U - \mu}{\sigma},$$

which is compared to a standard normal distribution. As the 1330 bulletins contain only ~150 shots their smaller sample size may reduce the statistical power of the method potentially leading to clusters of shots being overlooked, and so a critical Z -value of ± 1.64 was used to identify significant clusters of shots. Therefore, when $Z \leq -1.64$ we will identify a window that represents a cluster of low-ranking (i.e. shorter) shots; and, when $Z \geq 1.64$ we will identify a cluster of high-ranking (i.e. longer) shots. A set of time series of running Mann-Whitney Z statistics was generated for each bulletin in the study using multiple moving windows of $n_1 = 10, \dots, 15$ shots; and these were screened for the most significant clusters in order to remove redundant significant values resulting from the overlapping windows. To enable side-by-side comparison of the time series, the duration of each bulletin was normalized to a unit length by dividing the length of each shot by the total running time of the bulletin. The most significant non-overlapping windows of shots with high and low rankings were colour-coded and plotted on a single horizontal axis, with significant clusters of low- and high-ranking shots coded as blue and red, respectively. This makes it possible to transform event-based time series analysis into a time-based format via a simple method that is easy to interpret, and to compare the bulletins side-by-side in order to identify common structural features.

3. The discourse structure of ITV news bulletins

The discourse structure of a television news bulletin describes the overall pattern of the structural elements and the relationship between those elements. Montgomery (2007) provides a clear and comprehensive description of the discourse structure of television news bulletins at the macro-level of the broadcast as a whole and at the micro-level of the individual news items, and is used as a basis for describing the ITV bulletins in this study. Table 1 sets out the discourse structure of the 1830 broadcast from 8 August 2011 and Table 2 the discourse structure of the 1830 bulletin from 9 August 2011 as examples of the discourse structure of news bulletins on ITV 1.

ITV News bulletins are constructed from a narrow range of discourse elements; and follow a strict pattern consisting of an opening sequence that features the signature titles of the programme and establishes the main headlines; a series of discrete news items, broken up by a preview of upcoming news items (which precede the commercial break in the 1830 bulletins); and a closing sequence, in which the main headlines are restated, and the presenters signoff the programme before the credits. Other structural elements such as trails for later bulletins, newspaper headlines occur less frequently, but are nonetheless subject to strict constraints in that determine their place and function within the discourse of a bulletin.

ITV News bulletins begin with a sequence of headlines and programme titles divided into four sections. The first part of this sequence is the headline for the main news item presented by one reporter in close-up before a small section of news footage to illustrate the item, for a total of between 2 to 6 shots. This is then followed by the opening title shot featuring a track and pan across a series of glass panels displaying images from current news items, and lasts for ~18.5 seconds in the 1330 bulletins and for between 20.0 and 21.0 seconds in the two evening broadcasts. The headlines are then further developed in a sequence of between four and ten shots. Unlike the opening segment of the headlines, this is presented by a newsreader seated behind a desk and is shot as a medium close-up. The final shot of the opening sequence again features the ITV news logo, but this time lasts for only ~2.5 seconds. A single journalist presents the lunchtime bulletin and covers both of the headline segments in the opening sequence, but the 1830 and 2200 broadcasts both have two presenters (one female and one male) and the opening sequence switches between them. In the example in Table 1, the first of the headline sections is presented by one newsreader (Nina Hossain), while the beginning of the next headline sections is presented by the other (Mark Austin) and then the headlines announced over actuality footage for subsequent news items switches back and forth between the presenters.

Bulletins on ITV 1 feature two different types of news items: self-contained items with a kernel specific to that item, and which follow two basic patterns; and items that feature in a single series that are not differentiated by separate kernels. The dominant format of individual news items follows a strict pattern, in which the presenter states the essential content of the item in the news kernel and then introduces the news subsidiary to follow. This subsidiary component consists of a report and a live two-way interview between presenter and reporter, before the presenter ends the item. The second type of item is comprised of a live two-way interview between the presenter in the studio and a reporter at a location, and which may contain a short report within the overall framework of the interview. Occasionally, the presenter will conduct an interview with a key figure and/or commentator rather than with a reporter, but the structure of the item remains the same. The content of a news report may include to-camera pieces from a reporter, graphics, brief interviews with key individuals and/or members of the public, and actualities. Although

there is no restriction on the type of graphics that can be featured in either the kernel or subsidiary, the range of graphics used in a report includes maps, charts to display statistical information, or bullet-points to present key facts, whereas the use of graphics as part of the kernel is typically restricted to the use of maps. The majority of news items have their own kernel, with only seven bulletins featuring a series items undifferentiated by individual kernels, and only the 1830 Friday bulletin has two such series. A series contains 2 to 4 items, and the cumulative running time of a series ranges from 28.9s to 73.1s; while the median length for an individual item in a series is 16.3s, with a range of 10.2s to 27.7s. These reports are comprised of actualities or of stills photographed using a rostrum camera, and do not feature to-camera segments from a reporter, graphics, or brief interviews.

The bulletins in this sample feature between 5 items for the 1330 broadcast on 8 August and 13 for the bulletins at 2200 on 11 August and 1830 on 12 August; and, overall, the number of items in a bulletin increases over the course of the week. This may be accounted for by the division of reporting on the riots into shorter segments as the situation become more geographically diverse and more complex (see below), and an increasing number of brief items on a range of topics once the riots themselves had subsided. At the same time, the amount of time accounted for by the first item in each bulletin contracts over the course of the week for the same reason: the duration of the first items ranges from 527.6s to 745.3s on 8 and 9 August, but the range on the other three days of the week is from 148.9s to 456.6s. Again, this is due to the compartmentalisation of items on the riots: in Table 1 the coverage of the riots is presented as a single item that accounts for ~42% of the running time, but in the Tuesday evening bulletin in Table 2 this story has been divided by geographical location (London, Birmingham, other), and news items are beginning to reflect on and analyze events (Police tactics, community response, the experience of individuals, etc). Each of these items has an individual kernel and fulfils the functions required by their place in the discourse structure so that the bulletin follows the same macro-structure as a news bulletin in which each item has a different subject matter.

The last news item on the ITV television news is typically a human interest story, and is always introduced with the words 'And finally...'. Of the bulletins included in this sample, only the 1330 bulletins from 9 August and 10 August did not feature a final news item of this nature. The place in the discourse structure of this element is typically between the recap of the main news item and/or the review of the newspaper headlines in the 2200 bulletins and the closing sequence; and the median running time of the final item is 110.5s, with a range of 76.6s to 140.4s. This segment will often be of a (relatively) lighter, optimistic, and occasionally humorous tone; and such items in this sample cover the rescue of a whale stranded on an Australian beach, a blind musical prodigy, the death of World War II agent Nancy Wake, and the story of a recovering child in the East African famine (see Table 1). This remains the case when the bulletins are dominated by the riots. For example, the final item in the 1830 bulletin from 9 August dealt with the response of the communities affect by the riots in London (see Table 2), and stressed the efforts to clean-up after the riots and the public spirit of those who took pride in their community. This stands in stark contrast to the earlier items from the same bulletin that focussed on the violent clashes between looters and the police, and the destruction of property. Other stories from the riots to feature in this slot look at the experiences and the recovery of a Malaysian student mugged on the streets of London and the experiences of a furniture store owner whose century-old business was destroyed. Again, these news items therefore function as 'And finally ...' human interest stories within the broader context of the riots and fulfil the same role as items that occupy a similar position in the discourse structure of ITV News, even though the bulletins themselves are atypical in their concentration on a single topic.

The preview of upcoming news items signals the end of the first part of the programme and the onset of the commercial break in the 1830 bulletins. The section of the 1830 bulletins that precedes the commercial break accounts for between 71% and 75% of the bulletin of Monday, Tuesday, and Thursday, but only ~64% on Wednesday or Friday. It is unknown if this is a general pattern, or if there is a particular reason for the difference. The second part of the bulletin then begins with a shot of the presenters in the studio. This pattern of preview-studio shot is present in all but two of the bulletins in the sample, even though the 1330 and 2200 broadcasts lack a commercial break, and serves the same function of dividing the bulletin into two parts even though the broadcast itself is continuous. Leaving aside those bulletins that have no preview element (at 1330 on 9 and 10 August), the median proportion of a news bulletin prior to and including the preview accounts is 59%, with a minimum of 41% and a maximum of 68%, when the bulletin does not include a commercial break. The median number of news items occurring before the preview in all bulletins that include this element is 4 (min = 1, max = 7) and the median number of items to occur after the preview is 5 (min = 3, max = 9). News items that occur after the preview also tend to shorter in duration, with a median running time of 104.2s (min = 10.2s, max = 388.5s), compared to a median of 161.6s (min = 9.4s, max = 699.2s) before the preview.

The later parts of a bulletin may include three distinct elements: trails for later bulletins, a recap of the main news item, and a review of some newspaper headlines. There are no instances of these elements featuring prior to the previews described above. Trails have been understood to evoke the place of bulletins in the flow of the television schedule, but they occur infrequently in this sample: only the Monday, Tuesday, and Friday 1830 bulletins feature this element. In all three instances, the trail is the last element prior to the closing sequence. In the example in Table 1, the trail is related to the human interest story on the famine in Somalia that precedes it and alerts the viewer to a special report on the same subject that will feature in the 2200 bulletin. A recap of the main news item occurs in 8 of the fifteen bulletins in the sample, comprising between 2 and 5 shots and ranging from 10.8s to 48.6s, and as noted may feature before or after the last news item. The 2200 bulletins feature a review of the front pages of three newspapers, which vary from day to day. This sequence is comprised of four shots in each of these bulletins, lasting for between 23.5s and 39.8s, and includes a shot of the presenter followed by a graphic of a front page against a pale background. None of the bulletins broadcast at 2200 feature a recap of the main news item, with the reviews of the front pages occurring immediately prior to the last news item where the recap is frequently placed. Consequently, there is no need for both these elements and the front pages fulfil the same function as the recap in other bulletins.

Each bulletin ends with the same sequence of structural elements: the sign-off by the presenter(s), a credits sequence, and a title card for ITN. This sequence may comprise three shots, in which each element is separate; or two shots, in which the sign-off and the credits are continuous. The credits shot at the end of the news bulletin features a mobile camera that performs the opposite movement to that in the opening title sequence, pulling away from the news desk to indicate the end of the broadcast. On occasion the credits will be shown over news footage: in the 2200 bulletin from 8 August, the credits were shown over a shot 20.4s in length showing live footage of the London riots. The amount of screen time taken by the closing sequence covers a range of 14.3s to 47.1s, with a median of 25.6s.

4. The formal structure of ITV news bulletins

4.1 Shot length distributions

Table 3 presents the descriptive statistics for the shot length distributions of each bulletin. The running times of the bulletins vary with the time of broadcast: the 1330 bulletins show little variation in their length from 22.25 minutes and the 2200 bulletins are all approximately 28 minutes in length, while the 1830 bulletins range from ~21 minutes to 23 minutes 39.3 seconds. The number of shots in a bulletin is generally consistent over the course of a week depending on the time of broadcast: four of the five 1330 bulletins have between 149 and 153 shots, while one has 171 shots; and the 2200 bulletins have between 214 and 230 shots. The 1830 bulletins show greater variation, with between 156 and 190 shots. Overall, there is little variation in the distribution of shot lengths of the bulletins. The median shot lengths of the bulletins range from a minimum of 4.0s to a maximum of 5.6s, with a median of 5.0s. The lower and upper quartiles exhibit little variation. The median of the lower quartiles is 3.1s, with all 15 bulletins in within ± 0.5 s; and the median of the upper quartiles is 9.1s, with 12 of the bulletins within ± 1 s. Consequently, there is little variation in the interquartile ranges, with a median of 5.9s (min = 4.1s, max = 7.8s). We also note that there is little variation in the dispersion of shot lengths as measured by Q_n , the values of which are covered by a narrow range, with a median of 3.3s and all fifteen bulletins within ± 1.1 s. The results of the two-way ANOVA (without replication) show there is no statistically significant variation in the median shot lengths by day ($F(4, 8) = 0.50, p = 0.74$) or by time of broadcasts ($F(2, 8) = 0.87, p = 0.45$). Equally, there is no significant variation in the dispersion of shot lengths (Q_n) by day ($F(4, 8) = 1.34, p = 0.33$) or by time ($F(2, 8) = 2.74, p = 0.12$). The plots of the median shot lengths and Q_n for different days at different times can be seen in Figures 1.a and 1.b, respectively.

4.2 Time series analysis

Figure 2 presents the normalized and colour-coded side-by-side comparison of the clusters of long and short shots in the sample. Although the discourse structure of these bulletins is governed by a strict set of constraints, there is no overall pattern to the formal structure. The number of significant clusters ranges from a low of five to a high of twelve, but shows no pattern by time or day of broadcast. There is no order in which the significant clusters of long or short takes occur: clusters of long shots may be followed by clusters of short shots and clusters of short shots may be followed by clusters of long shots, with numerous occasions when there appear to be runs of similar clusters. There are no trends or cycles evident over the course of the bulletins, and there are no clusters of shorter or longer takes common to the time series of all the bulletins.

It is worth noting that 68% of the clusters of short shots begin the second half of a bulletins compared to 32% that begin in the first half. (Only one cluster of short shots begins and ends in different halves of a bulletin). When considered along with the tendency of news items to run shorter after the preview element, this suggests that there is a quickening of the tempo of an ITV news bulletin in its second half. However, this conclusion must be regarded as tentative given that this sample covers only a single week of broadcasts and there is at present no research on the viewer's perception of pacing in UK television bulletins. There is no similar pattern for the clusters of longer takes in this sample, with 59% beginning in the first half of the bulletin. We also note that the 1830 bulletin from 12 August does exhibit a particular pattern, with the clusters of longer takes all occurring before clusters of shorter shots, the latter of which all occur in the final quarter of the programme. This pattern is not evident in any of the other bulletins in this sample, and it is unknown if it occurs in other ITV news bulletins.

While the results show that there is no particular pattern, we can identify some of the structural elements of the discourse of television news as being associated with clusters of longer or shorter takes. Clusters of long takes occur when there are several shots of people talking on screen in proximity to one another. This includes the kernel of a news item, press conferences, interviews with named key figures in news items, the reporter talking directly to camera at the beginning and/or end of a report, and the live 2-way interviews. To illustrate this aspect we use the 1830 bulletin from 9 August described in Table 2, which contains four such clusters. The first cluster at 0.07 in Figure 2 begins with the kernel for the main item on the London riots, and includes footage of a press conference by the Prime Minister. This cluster is 15 shots long and runs for 144.8 seconds, with 11 of these shots longer than the than the median shot length of the whole bulletin (min = 2.7s, median = 6.3s, max = 40.8s), and the longest of which is the news kernel. The cluster at 0.23 includes a live 2-way interview between a presenter and the Mayor of London, and a two shot of the presenters in the studio introducing the next part of this item. This cluster is 216.0 seconds in length (min = 2.7s, median = 6.8s, max = 60.8s), with 9 of 11 shots longer than the overall median shot length. From the same bulletin, we see two later clusters (at 0.70 and 0.79) that exhibit the same characteristics. The first of these clusters is 10 shots in length, of which 8 are greater than the overall median, and lasts for 89.9 seconds (min = 2.6s, median = 7.3s, max = 19.7s); and includes an interview with a social commentator as part of the item showing police footage of the riots, the deliberate discourse work by the presenters to announce the break for advertisements, and the kernel of the first post-break item on policing tactics. The second cluster is also part of this item on the policing of the riots, and is also ten shots long, of which 9 are greater than the overall median, and lasts for 87.9 seconds (min = 3.8s, median = 7.3s, max = 17.4s); and includes footage of the riots intercut with a to-camera piece by the reporter and two 'talking-head' interviews with current and retired police officers. The elements of the discourse of the bulletins that are common to clusters of long takes tend to be filmed in the same way, with a static camera and a static subject framed in either a medium close-up or a medium shot.

Clusters of shorter shots are associated with four different elements of news discourse. The most frequently occurring clusters are montages with a voice-over provided off-screen by a reporter. For example, the cluster at 0.27 in the 1830 bulletin from 10 August is part of an item on the riots in Manchester; and lasts for 67.6s (min = 2.1s, median = 3.6s, max = 9.8s), with 10 of the fifteen shots less than median shot length of the bulletin. This cluster is primarily composed of a series of stills of rioters provided by Greater Manchester Police and news footage of the riots themselves, with the events depicted described by a reporter who does not feature in any of the shots. Similarly, in the item on the community clean-up after the riots in the 1830 bulletin on 9 August (see Table 2) the cluster at 0.94 features shots of the people of London clearing debris from the streets while the off-camera reporter describes the mood of the public rather than the action itself. This cluster is 40.3 seconds long, with 9 of the 11 shots less than the median of the bulletin (min = 2.2s, median = 3.4s, max = 6.0s), and follows on after the reporter's 'to-camera' piece.

The second common factor is sports reporting. Seven of the clusters of shorter shots are associated with items on England's cricket test match series against India. For example, the cluster at 0.87 in the 1330 bulletin from 12 August is 35.5 seconds long (min = 1.3s, median = 2.0s, max = 5.8s), with 14 of the 15 shots shorter than the median of this bulletin. Another such clusters occurs at 0.87 in the 2200 bulletin from 10 August, with a report on international football fixtures that features clips of matches (min = 1.3s, median = 3.4s, max = 8.2s). However, the item on Arsenal's transfer policy from the 1330 bulletin on 12 August is not associated with any such cluster. In fact, the four shots constituting this item are part of

the cluster of longer shots that occurs at 0.76 in this bulletin, and range from 8.1s to 23.7s. Again, the item previewing the 2011/2012 Premiership season from the 2200 bulletin on 12 August is associated (in part) with a cluster of longer rather than shorter takes. This item is 18 shots in length (min = 0.9s, median = 7.7s, max = 24.8s), and the final 7 shots are a part of the cluster of longer takes that occurs at 0.85 in Figure 2. Like other clusters described above, these shots include footage of press conferences and reporters speaking to camera in proximity. This difference suggests that sports *action* is formally different from sports *news*, though they typically have similar positions in the latter part of the discourse structure of a bulletin.

Sequences of actualities that cover several items in quick succession without differentiating kernels are often associated with clusters of short shots. For example, the cluster at 0.76 in the 2200 bulletin from 9 August, which is 12 shots and 49.0 seconds long (min = 1.7s, median = 3.9s, max = 6.8s), and which covers items on a murder conviction, and the Libyan and Syrian uprisings. However, this cluster does not include the first item in this sequence (on jobs cuts in the banking sector), and so does not include the initial kernel. A similar example can be seen in the cluster at 0.72 in the 2200 Bulletin from 11 August covers a series of three items on the Syrian uprising, a rail crash in China, and the famine in East Africa (min = 2.1s, median = 3.2s, max = 5.8s). This sequence is 11 shots long, but the cluster of short takes includes only 10 shots running for 37.1 seconds; and, again, does not include the kernel that begins the sequence, which at 8.8 seconds is three seconds longer than the next longest shot in the sequence.

Finally, clusters of shorter takes are associated with footage that is not produced by ITN news, including footage from other broadcasters, library footage, and clips from feature films. For example, the last item in the 2200 bulletin on 8 August looked at the life of the World War Two spy Nancy Wake, who was the inspiration for Cate Blanchett's character in the film *Charlotte Gray* (2001), and included within the report scenes from this feature film along with library footage of the D-Day landings. This footage forms the major part of the cluster at 0.96 in this bulletin, which runs for 10 shots and 29.6 seconds (min = 1.6s, median = 2.5s, max = 6.4s), while the rest of this item is not associated with a specific editing regime.

If we consider the item on the world's stock markets from the 2200 bulletin on 8 August, we can see how the editing changes over the course of an item. This item is divided into two parts, with the first section focussing on the New York Stock Exchange following the downgrading of the United States' credit rating and the second looking at the crisis in the Euro zone and its impact on share prices. This item is 388.5 seconds long and begins at 0.43 in Figure 2, covering four distinct clusters – two clusters of shorter takes and two clusters of longer shots. The first four shots of the item, including the kernel, are not a part of any cluster. These are followed by an 11 shot cluster of shorter takes running for 44.3s (min = 2.2s, median = 3.8s, max = 7.2s), comprised of a montage sequence of the New York Stock Exchange and the trading floor of a financial company, while the reporter describes the impact of the downgrade off-camera. This is immediately followed by a cluster of 12 longer shots running 153.4s (min = 2.8s, median = 9.1s, max = 53.5s), that includes an interview with a trader, press conferences from President Obama and Mitt Romney, and a live 2-way interview between London and New York all framed as static medium shots. The final shot of this cluster is of the studio presenter linking events in the US with those in Europe, and this is immediately followed by a cluster of 13 shorter takes running 42.3s (min = 1.6s, median = 3.3s, max = 5.4s). This third cluster is another montage sequence with voice-over description by an off-camera reporter, and includes within it footage from a French broadcaster on the same subject. As such it combines to different types of the clusters of short takes that we find

in this sample. The final cluster of longer includes 11 shot cluster runs for 138.2s (min = 2.9s, median = 11.1s, max = 32.6s), and the last two shots of this cluster belong to the following item (accounting for 27.0s). The shots in this cluster belonging to the item on the stock markets include interviews with an economist and a banker, a graphic providing statistical data, and a live piece to camera from a reporter. This example demonstrates it is the presence of particular structural elements (the montage sequences, interviews, live 2-ways, etc) and the order in which they occur that determines the ebb and flow of the formal structure of an individual news item. These discourse elements and editing regimes also reveal a repetitive functional structure of description (the quickly edited sections) and comment and analysis (which is edited more slowly) apparent in both the sub-sections of this item. By extension, the overall formal structure of a news bulletin is also determined by the presence of and sequence in which discourse elements are presented.

5. Conclusion

This paper analyzed the distribution and time series of shot lengths in ITV news bulletins. The bulletins in this sample follow a strict discourse structure (though individual elements may be missing from some bulletins) that remains constant even when the content of a bulletin is atypically dominated by a single subject. This suggests news content is produced in such a way as to meet the constraints of the discourse structure rather than vice versa. The statistical analysis shows (1) the distribution of shot lengths in the bulletins show little variation and there is no evidence that day or time of broadcast are important factors in shaping form; (2) there is no overall formal structure to the bulletins, with no trends, cycles, or clusters occurring at common points; but, (3) clusters of longer and shorter shots are associated with a range of different structural elements, and the formal structure of a news bulletin and of individual news items depends on which discourse elements are included in a bulletin and the order in which they occur.

This paper demonstrates that ordinal time series methods can be used to explore and describe the formal structure of television news bulletins, and to relate this to their discourse structure. Future research in this area will need to expand the scope of this study in three areas. The sample used here covers only a single week and in the first instance it will be necessary to expand the sample to cover a longer time period and thereby test the consistency of the above conclusions. By analysing a larger sample it will also be possible to explore in greater depth the relation between discourse, form, and content. Second, it is necessary to expand future studies to include other broadcasters in the UK to determine if there are common features to news reporting in British television or if different broadcasters adopt different structures of discourse and form. Finally, a comparison between broadcasters in the UK and in other countries will allow us to understand how form varies in different contexts.

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Time series analysis of ITV News bulletins

Table 1 The discourse structure of the 1830 ITV 1 news bulletin broadcast on 8 August 2011

Segment	Structural elements	Shots	Running time (s)	Cumulative running time (s)	Cumulative normalized running time	Description
Headlines	Presenter + Actualities	3	26.7	26.7	0.02	Main headline for item on London riots
Title		1	20.4	47.1	0.04	The main title for the bulletin
Headlines	Presenter + Actualities	6	28.4	75.5	0.06	Second London riots headline, and headlines for stock market, Syrian uprising, and East African Famine
Title		1	2.5	78.0	0.06	ITV News logo
News Item	Kernel + Report/2-way	52	527.6	605.6	0.48	London riots
News Item	Kernel + Report	41	204.4	809.6	0.64	Stock market slump across the globe
News Item	Kernel + 2-way	3	59.7	869.3	0.69	School pupils recovering after Polar Bear attack
Preview	Presenter + Actualities	5	22.1	891.4	0.71	Announcement of the commercial break, and preview of upcoming item on cancer report
Studio		1	6.9	898.3	0.71	The presenters in the studio after the break
News Item	Kernel + Report	13	104.5	1002.8	0.80	Political crisis in Syria
News Item	Kernel + Report	25	122.1	1124.9	0.89	The benefits of exercise for cancer patients
Recap	Presenter + Actuality	2	11.3	1136.2	0.90	Recap of main item on London riots
News Item	Kernel + Report	15	86.8	1223.0	0.97	Human interest story on a child receiving aid in the East African Famine
Trail	Presenter + Actualities	5	16.5	1239.5	0.99	Trailing an item at 2200 on the East African Famine
Signoff/Credits/ITN Title		3	18.3	1258.7	1.00	

Time series analysis of ITV News bulletins

Table 2 The discourse structure of the 1830 ITV 1 news bulletin broadcast on 9 August 2011

Segment	Structural elements	Shots	Running time (s)	Cumulative running time (s)	Cumulative normalized running time	Description
Headlines	Presenter + Actualities	6	38.3	38.3	0.03	Main headlines on riots
Title		1	20.2	58.5	0.05	The main title for the bulletin
Headlines	Presenter + Actualities	7	30.7	89.2	0.07	Secondary headlines on riots, referring to London, police tactics, and community response
Title		1	2.9	92.1	0.07	ITV News logo
News Item	Kernel + Report/2-way	62	576.1	668.2	0.52	London Riots
News Item	Kernel + Report	23	112.7	780.9	0.61	Birmingham Riots
News Item	Kernel + Report	7	26.5	807.4	0.63	Riots elsewhere in the UK/England match cancelled
News Item	Kernel + Report	20	142.9	950.3	0.74	Police footage of rioters
Preview		3	16.9	967.2	0.75	Preview of human interest story on community response to the riots, and announcement of break
Studio		1	6.3	973.5	0.75	Post- break shot presenters in studio
News Item	Kernel + Report	19	135.4	1108.9	0.86	Police Tactics
News Item	Kernel + Actuality	2	18.7	1127.6	0.87	Rape Conviction
News Item	Actualities	3	10.2	1137.8	0.88	Murder Conviction
News Item	Kernel + Report	21	106.7	1244.5	0.96	Community response and post-riots clean up
Recap	Presenter + Actualities	4	10.8	1255.3	0.97	Recap on London riots news item
Trail	Presenter + Actualities	7	17.4	1272.7	0.99	Trailing an item at 2200 on how the riots have been reported around the world
Signoff/Credits/ITN Title		3	17.8	1290.5	1.00	

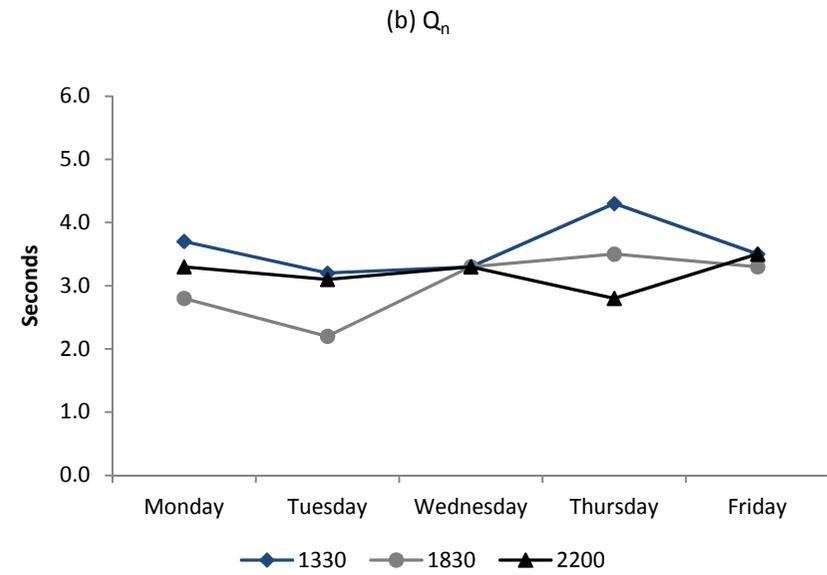
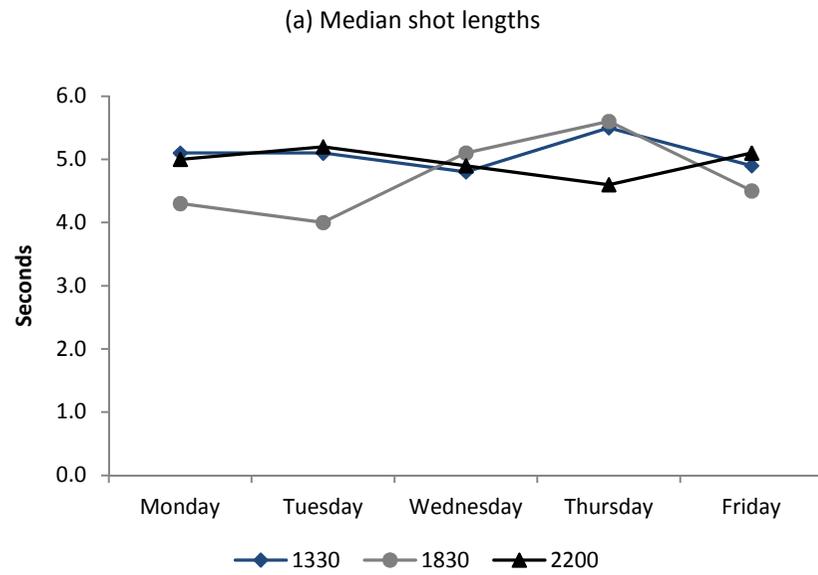
Time series analysis of ITV News bulletins

Table 3 Descriptive statistics of shot length distributions for ITV 1 News bulletins, 8 August 2011 to 12 August 2011

Bulletin	Length (s)	Shots	Minimum (s)	Lower Quartile (s)	Median (s)	Upper Quartile (s)	Maximum (s)	Q_n (s)
08/08: 1330	1335.0	149	0.6	3.1	5.1	9.7	74.3	3.7
08/08: 1830	1257.8	176	0.3	2.8	4.3	8.4	54.1	2.8
08/08: 2200	1729.4	217	1.4	3.3	5.0	9.1	55.8	3.3
09/08: 1330	1335.0	150	1.5	3.4	5.1	9.9	60.8	3.2
09/08: 1830	1290.5	190	1.2	3.0	4.0	7.1	60.8	2.2
09/08: 2200	1699.5	214	1.0	3.4	5.2	9.2	78.1	3.1
10/08: 1330	1335.0	153	1.2	3.3	4.8	9.9	71.4	3.3
10/08: 1830	1419.3	168	0.6	3.4	5.1	8.7	94.0	3.3
10/08: 2200	1708.6	222	0.8	3.1	4.9	9.0	64.2	3.3
11/08: 1330	1334.4	152	0.0	2.8	5.5	10.6	54.0	4.3
11/08: 1830	1289.8	156	1.6	3.5	5.6	9.6	65.2	3.5
11/08: 2200	1669.4	230	1.0	3.1	4.6	7.7	101.9	2.8
12/08: 1330	1334.2	171	0.2	2.6	4.9	8.9	76.4	3.5
12/08: 1830	1350.0	185	0.2	2.7	4.5	8.3	62.2	3.3
12/08: 2200	1669.9	219	0.9	3.0	5.1	9.3	41.6	3.5

Time series analysis of ITV News bulletins

Figure 1 Variation in median shot length and dispersion of shot lengths by day and time of broadcast for ITV 1 News bulletins, 8 August 2011 to 12 August 2011



Time series analysis of ITV News bulletins

Figure 2 Side-by-side comparisons of the most significant non-overlapping regimes of short and long shots based on running Mann-Whitney Z statistics using multiple windows ($n_1 = 10 - 15$) in ITV News bulletins, 8 August 2011 to 12 August 2011

