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Interactive Analytical Treemaps for Visualisation of Call Centre Data

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Abstract

In the United Kingdom alone, there are over one million employees working at over 5,000 call centres. Some estimates claim approximately four million call centre employees in Europe. In this unique application paper we present methods for visualising the vast amount of data generated and collected by call centres. We design the application to address the challenges of exploration, analysis and visualisation of complex, time-dependant call centre data, and aim to maximise the utility the software contributes to the business stakeholders in the industry. The application implements a custom, interactive analytical treemap view that presents an overview and details of the data on demand. We implement a smooth temporal navigation system to allow the user to zoom the visualisation to a higher resolution of data. Then an interactive multivariate focus and context analytic filtering interface provides the user control over caller subsets they are interested in for analysis. The software is designed in close collaboration with industry experts. This application reveals new insight into call centre events and behaviour that traditional forms of analysis do not as quickly, nor as easily. We also report the positive reaction of domain experts to our visualisations.

Categories and Subject Descriptors (according to ACM CCS): I.3.4 [Computer Graphics]: Graphics Utilities—Application packages

1. Introduction & Motivation

Over the past two decades, a rapid expansion has taken place in the call centre industry. With an estimated 5,000 call centres, one million employees [Cal], and a revenue of £2.3 billion [rev] in the UK alone, the call centre industry makes a notable contribution to the UK GDP [GDP]. Some estimates claim that almost 4 million people are employed accross 35,000 call centres in Europe [eur]. † Due to the growth of this massive industry, it is argued that call centres are becoming the modern world equivalent of the factory, generating a valuable service as opposed to a product [Hud12, VvWVdL06]

Focus is often placed on the quality of the service provided by the call centres. It has been noted that there are intangible aspects of customer service that cannot be measured easily or the current measures in place do not account for [Gil01]. For example, agents working in a call centre are given a temporal target in which they aim to deal with each customer. These targets can create a negative impact on the customer experience and therefore need to be quickly discovered and addressed.

The drive for improvement relies on the correct measures of efficiency and the ability to present the call centre activity in an accessible way so that the correct course of action can be taken [CM97]. The collection of the call centre event level data itself is handled by our partner company QPC Ltd, however the analysis, exploration, and presentation of that data is at an early stage of research. Here we present methods for visualising the large amounts of event based data from a call centre in a unique, novel application, with the intended end user being a decision maker within the contact centre.

This paper contributes methods by which we can interactively view and analyse large amounts of call centre data, hundreds of thousands of calls with several million events (around 4 million per day), identifying temporal trends and highlighting issues in customer wait times. The application enables smooth visual exploration of the multivariate data through an interactive focus + context, analytical treemap that ranges from a full day overview down to a single call detail level. Our contributions are:

- The introduction of call centre data visualisation to the visualisation community.
- An enhanced treemap visualisation with smooth interactive zooming and panning in a feature-rich application.
- Novel interactive analytic filtering options coupled with focus + context visualisation that enables users to focus in on special subsets of calls of interest.
- New observations of call centre activity and domain expert feed-

† That's roughly half the population of Switzerland [Swi].

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back of the visualisation demonstrating the utility of the software.

All of the features are driven by our requirements analysis and discussions with QPC Ltd.

The next section covers the related work in the field of this research. Section 3 discusses the data and application solution. In section 4 we provide an overview of the software, and describe the features it offers. Section 5 contains the domain expert feedback from our industry partners QPC Ltd with whom we worked closely to carefully design the software. We conclude by summarising the work and discussing future work in section 6.

2. Related Work

Related work falls into two categories: research related to call centres and treemap visualisations.

2.1. Call Centre Analysis

As an academic area of research, the call centre events are relatively unexplored. From a technical perspective, the operation of efficient data routing in a call centre has been researched in the network domain by Adetunji et al. [ASLM07, AL08a, AL08b]. The general architecture of an IP-based call centre was made by Smith in 2007, outlining the general technical functionality of a call centre highlighting the importance of the automatic call distribution (ACD) machine [Smi07]. These papers focus on the technical design and operations of the centre, not the efficiency of their staff, nor the customer experience.

A call centre's customer service quality is highly important to the business it represents because the centre exists for the benefit of the customer. In many cases it will be the only point of contact the customer has with the business and they therefore need to make a positive impact. Raja et al. conducted research in this area to discover what effects the employees emotional intelligence, job satisfaction, and work load have on the quality of the customer service they provided [RME*10]. Extensive research exists in the fields of managing customer expectations through service control. Specifically customer satisfaction is regarded as a necessity when operating in the call centre industry and research has gone into the maximisation of this metric [FKH*00, BCC00]. Directly linked to this metric is the level of service quality the call centre operates at. In this field, research identifies the aspects of call centre operations that have positive and negative effects on the quality of service and therefore customer satisfaction [Jai08, Gil01].

Customer feedback is highly valued within the call centre industry but is costly to obtain. Research into sentiment analysis aims to enable call centres to calculate the customers experience without having to collect feedback from the customer [PGP*15, GKK*13].

2.2. Treemap Visualisation

The original treemap was developed as a space filling visualisation of hierarchical data in 1991 [JS91, Shn92]. The treemap was improved by Bruls et al. by creating an algorithm that generates more square nodes [BHVW00]. This enables the user to better compare the nodes against each other. The layout of these nodes was originally optimised for position, but Shneiderman and Wattenberg developed an algorthm to create a treemap that maintains an order to the nodes [SW01]. This opens up the visualisation to hierarchical, temporally-ordered data.

Treemap visualisation aesthetics have been developed so that the structure of the tree can also be shown through its shading [VWVdW99].

Focus + context visualisation has been applied to the treemap that preserves the treemap properties, but focuses on selected nodes by enlarging them whilst maintaining order [TS08]. The emphasis of the research by Tu et al. is on the layout algorithm itself and how to efficiently enlarge the focus [TS08]. User evaluations of treemap browsing have been performed, analysing the focus + context fish eye and full zoom views [SZG*96, SIL05]. Changes in hierarchical data can be visualised using a treemap as long as it uses a consistent visual pattern layout [TS07].

Blanch and Lecolinet present a method by which a user can navigate large treemaps using a pan and snap zoom interaction [BL07]. In contrast to our software, this method only zooms in on one axis at a time (x or y) and does not account for squarified treemaps. Zooming then results in more data detail along the elongated axis, x or y. In their application zooming in on one axis at a time makes sense since their layout algorithm produces elongated rectangles. However it's easy for the observer to get lost as any overview disappears when zooming in. Ours zooms in smoothly on both the x and y axes, preserving overall shape geometry. This helps prevent the user from getting lost in close up views. An overview call volume histogram and clock dial interface also prevents the user from losing their temporal orientation in our navigational interaction.

We also incorporate a focus + context visualisation. The emphasis here is on the interactive analytic filtering of the data to enable special event-based questions to be answered. See section 3.3 for more on this topic.

Huang et al. combine the treemap with a bar chart to create a hybrid visualisation that can display hierarchical data in a histogram view [HHZ09]. These treemap mutations are popular for improving the aesthetic of the visualisation. Zhao and Lu created a variation of the treemap that sacrifices the traditional space filling aspect and replaces it with circular nodes. The benefits of which encourage user interaction through focus + context features [ZL15].

As a further development of the treemap, Vliegen et al. present business data using various adaptations of a treemap [VvWVdL06]. Some radial methods are used and some treemap nodes are shaped into triangles or leaf shapes. These visualisations are aesthetically appealing but often sacrifice readability or consistency.

Our work is the first to develop visualisation of call centre data using treemaps. We enhance the traditional treemap visualisation with a customised smooth zooming and panning interaction and customised analytic filtering options especially for the detection of patterns and outliers in very large numbers (millions) of call centre intra-day events.

3. Application Background and Call Centre Data

Our partner company QPC Ltd provides us with 24 hours worth of call centre activity data. Each call record contains timestamps for each sub-event, flags to denote the classification of call and a range of additional information about the call and customer journey. The data is anonymised to avoid the release of sensitive information.

3.1. Challenges:

The biggest challenge when attempting to present data of this nature is one of scale. Over a quarter of a million calls, and over four million call events are collected each day, the data is difficult to manage. Accounting for each event collected by the call centre very quickly generates large amounts of data, and attempts at visualisation often result in obfuscation. To overcome this problem programmatically, an object is created to represent a single call instance, clustering together the events of a call into a single object. Within this call object all important characteristics are stored, from timestamps to customer details, omitting unnecessary details. Once the call objects have been constructed, they can be directly accessed to create the visualisations.

3.2. Call Components

Each call can be sub-divided into three event groups.

The IVR (Interactive Voice Response) is the call distribution system that routes the call to an agent with the appropriate knowledge base. The caller listens to pre-recorded messages instructing them to respond to key-presses corresponding to different departments of a call centre. Numerous IVR events can occur per call, which is captured as meta-data associated with the customer call journey.

Queue events are instances of the caller waiting in a queue to speak to an agent. Agent events are instances of the caller being put through to a live call centre employee.

There can be multiple IVR, queue and agent events per phone call. All events are given time stamps, and extra meta-data, e.g. agent event meta data contains information about the agent that was spoken to. This helps identify transfers between departments, thus possibly increasing customer dissatisfaction.

Contained within the dataset are further meta-data about each call; an abandoned flag shows whether the call was hung up before the caller spoke to an agent, the type of call is recorded (i.e. internal or external call), and details about the different call events.

3.3. Application Questions and Requirements

The goal of this research is to create a system that can produce answers to questions the domain experts have about the data and call centre behaviour.

- Can we see an overview of hundreds of thousands of calls?
- Are there any patterns in caller behaviour? Any outliers?
- At what point do callers abandon calls? And what reasons might there be for this?
- Can the system easily identify groups of similar calls?
- What's the best way to filter calls and obtain details on demand?
- When do customer wait times increase and decrease?

The software should enable exploration, analysis, and engagement with the call centre activity, starting with an overview.

4. Visualising Call Centre Data with Interactive Analytic Treemaps

We created an analytic visualisation system to explore the call centre data and identify previously unobserved trends using interactive analytical treemaps. We chose to start with treemaps in order to gain the very first overview of a complete day's worth of calls. This version of the treemap conveys the temporal nature of the data by creating a layout whereby the calls are displayed within the treemap nodes. This is done by creating 24 individual treemap nodes, each representing an hour in the call centre where the complete overview shows one full day of data. This is achieved by utilising the natural hierarchy of time (day, hour, minute, second) and sub-dividing the hour nodes into six nodes, each ten minutes in length. Each of those nodes split into ten nodes representing one minute in of incoming calls (Figure 1).

4.1. Implementation

We chose to create the software using the C++ framework of Qt alongside the graphics library of OpenGL. Data is passed into the software directly from the QPC Ltd. SQL database so that the visualisations can easily be used by the company's analysts.

4.2. Treemap Layout and Construction

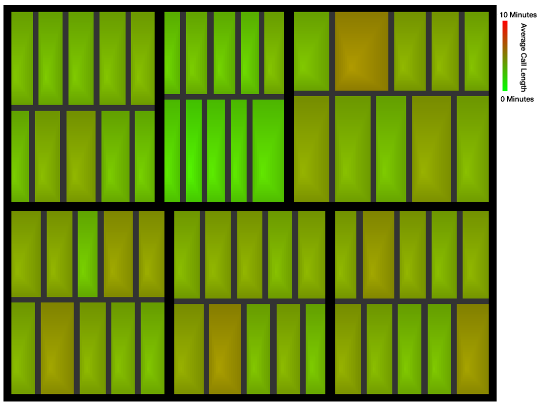

Figure 1: *This figure shows an individual hour node. It is sub-divided into six nodes of ten minutes, and each of those is split into 10 individual minute nodes. The layout order starts from top-left down to bottom-right. The hour 13:00 - 14:00 is shown. Colour is mapped to average call length and the size of each node represents call volume.*

The construction of the treemap is initialised when the user selects from a list of available dates. When starting the treemap layout algorithm, the 24 hours of data is sub-divided into the individual hour nodes. Hour node volumes are initialised by summing the total length of each call within each hour. The hour with the largest volume is then mapped to the maximum node size. From here the internal nodes for each hour node are scaled and placed.

We construct the hour nodes using hierarchical levels, 6 nodes fill one hour node and are scaled by the call volume within the 10 minutes that each node represents. Each 10 minute node is split into individual 1 minute nodes which in turn contain nodes for each call that enters the call centre within a given minute.

To layout each call within their parent node, we use the strip treemap algorithm [BSW02]. The benefit of this method is that order is maintained in the data. Preserving the order of this is important due to the temporal nature of the data. We have swapped a timeline visualisation for a treemap visualisation for the treemap's

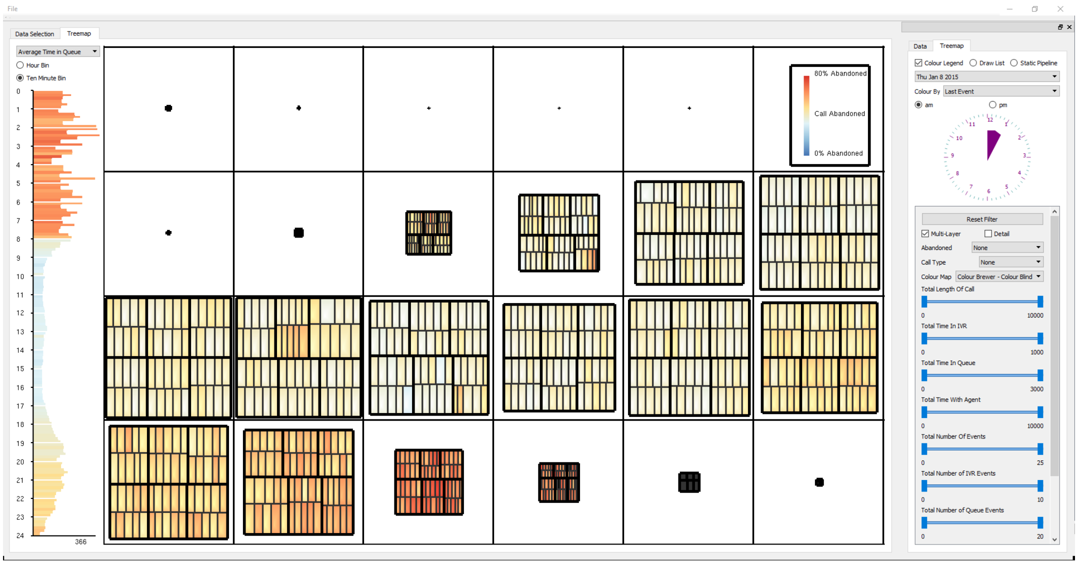

Figure 2: *This figure shows the complete software interface. The central visualisation shows the treemap grid that depicts a full day of caller data across 24 single hour treemaps. On the left, the interactive histogram can be seen showing the average queue time within each 10 minute time interval. The colour map for both the histogram and the treemap represents the abandon rate. The right panel shows the interface for the colour map options, clock interface, and interactive filtering system.*

space filling properties. Because of this swap, we can see the full twenty four hours on data in one screen and easily observe trends and features in the data (See Figure 2). For example the gradual increase in abandoned calls throughout the work day. A traditional timeline visualisation, which we also attempted, is far too large to display this volume of data efficiently.

4.3. Temporal Navigation with Smooth Zooming and Panning

Our application introduces a multi-resolution visualisation by revealing lower levels of the hierarchy the closer the window zooms into a node. Users can navigate over the data using a smooth pan and zoom mechanism adapted from the previous work by Van Wijk and Nuij [VWN03]. The primary navigation mechanism enables the user to select an an hour time frame from a clock interface. The application animates a zoom transition from the current window to the desired focus hour node smoothly and automatically (Figure 3).

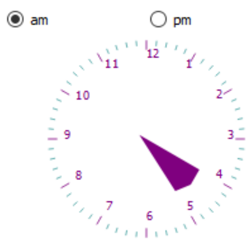

Figure 3: *The user can select an hour on the clock interface to start the smooth zooming and panning animation to the new hour. Selecting the 'pm' radio button changes the clock to the afternoon hours.*

Smooth Animation: In order for the user to maintain their orientation whilst navigating the treemap visualisation the selection of a new hour through the clock interface, the histogram, or a direct selection of an hour node animates a smooth zoom away from the current hour, followed by a translation, and again into the canvas on the new hour such that the treemap fills the screen.

When the animation starts, the window zooms out from its current frame to show the full overview and context of the visualisation and then zooms in towards the target destination. The animation path is derived using the methods by Van Wijk and Nuij [VWN03].

We model the viewpoint paths after those of Van Wijk and Nuij [VWN03]. Here we briefly summarize the result of their detailed optimal path derivation. The optimal path for $(u(s), w(s)), s \in [0, S], u_0 \neq u_1$.

$$
\begin{aligned}
u(s) &= \frac{w_o}{\rho^2}\, cosh\, r_0\, tanh(\rho s + r_0) - \frac{w_o}{\rho^2}\, sinh\, r_0 + u_0 \\
w(s) &= w_0\, cosh\, r_0 / \, cosh(\rho s + r_0), \\
S &= (r_1 - r_0)/\rho, \\
r_i &= ln(-b_i + \sqrt{b_i^2 + 1},\ i = 0, 1,\ and \\
b_i &= \frac{w_1^2 - w_0^2 + (-1)^i \rho^4 (u_1 - u_0)^2}{2 w_i \rho^2 (u_1 - u_0)},\ i = 0, 1
\end{aligned}
$$

Where u is a curved line from start to end, w describes the elliptical space mapped to height (away from the zooming plane), and s describes start and end points. The parameter ρ represents a trade-off between zooming and panning. The hyperbolic cosine, sine, and tangents are defined as $cosh\ x = (e^x + e^{-x})/2$, $sinh\ x = (e^x - e^{-x})/2$, and $tanh\ x = sinh\ x\ /\ cosh\ x$. For $u_0 = u_1$ the optimal path is:

$$u(s) = u_0$$

$$
\begin{aligned}
w(s) &= w_0 \, exp(k\rho s) \\
S &= |\, ln(w_1/w_0)\,| / \rho \\
k &= \left\{ \begin{array}{c} -1 \; if \; w_1 < w_0 \\ 1 \; otherwise \end{array} \right\}
\end{aligned}
$$

For the full derivation of this result, we refer the reader to Van Wijk and Nuij [VWN03].

In order to prevent obfuscation of the visualisation, when the viewpoint is zoomed out to its maximum only minute level call details are shown. When the user zooms in the call level of detail (LoD) smoothly fades into view and the minute level data fades seamlessly out. This automatic level-of-detail feature helps the user maintain a context by which they are viewing the visualisation and creates a smooth transition between the high and low level details.

The twenty-four hour grid view is not a space filling visualisation because the temporal order of each hour node is better preserved on a spatial grid. Since the size of each node is mapped to total call volume per hour in the overview visualisation, some nodes are very small, e.g. 1am. To compensate for the small nodes all transitions between hours zoom directly to fill the window with the node, not the larger grid. This way the space is not wasted. The user never has to navigate manually over white space if they do not wish to. Please see accompanying video for a demonstration.

4.4. Interactive Histogram

In addition to the analytical treemap, the vertical histogram widget gives the user insight into the distribution of the call metrics. Each variable that can be displayed in the multivariate filtering system can be shown in the vertical histogram after being selected from a drop down menu. The bars of the histogram can either represent 1 hour nodes or 10 minute nodes from the treemap. We colour the bars using the same colour map used by the treemap. This extra variable is helpful as it enables the user compare any two variables for trends (see figure 4).

If the user wishes to inspect the data in the histogram more closely, they may select a bar and the treemap visualisation will smoothly zoom to that time frame. This navigational method can be used alongside the clock interface so that the user can chose which system to use. The interactive histogram is a feature request from our industry partner.

4.5. Analytical Colour Map Options

Due to the LoD zoom options, different leaf nodes of the tree are visualised at different times. To maintain consistency, the call attribute that the colour is mapped to remains consistent across the hierarchy levels. If call nodes are coloured by the length of each call, then the minute node will be coloured by the average length of each call initiated within that minute. (See Figure 5).

The user has a selection of colour maps to choose from when using the software. The default colour map is a green-red map because those colours are typical indicators of good and bad events. This is also the colour map requested by our partners at QPC Ltd. There is also a selection of other maps that use multiple colours and are designed to be colour blind friendly adapted from the website Color Brewer [Col].

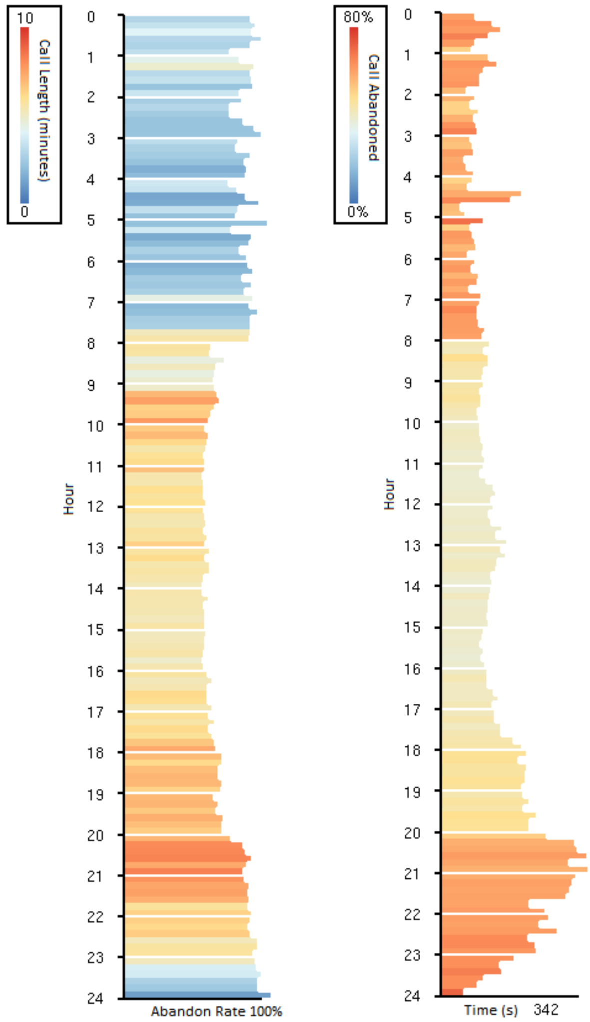

Figure 4: *This figure shows the interactive histogram using 10 minute nodes. The left image shows abandonment rate throughout the day where the bins are coloured by the average length of calls within the bin time frame. The right histogram shows the average time spent in the queue where the colour map shows the abandonment rate.*

A range of call attributes are available for the user to select. Initially, call length of call is mapped to colour, but other metrics such as call volume as well as percent of calls abandoned can be visualised. The benefit of these colour maps is that the user can see a complete overview of that call attribute for one day and are able to drill down into the visualisation easily to get event level data.

4.6. Multivariate Call Filtering Techniques

With the large amount of data, it can be difficult to find trends in the call centre. To overcome this, we have implemented an analytical filtering system that provides the user full control over the types of calls that are displayed. Traditionally treemap nodes can display two variables through size and colour (in addition to the hierarchy layout). This system allows users to filter out calls using a wide range of attributes and multiple filter criteria can be set simultane-

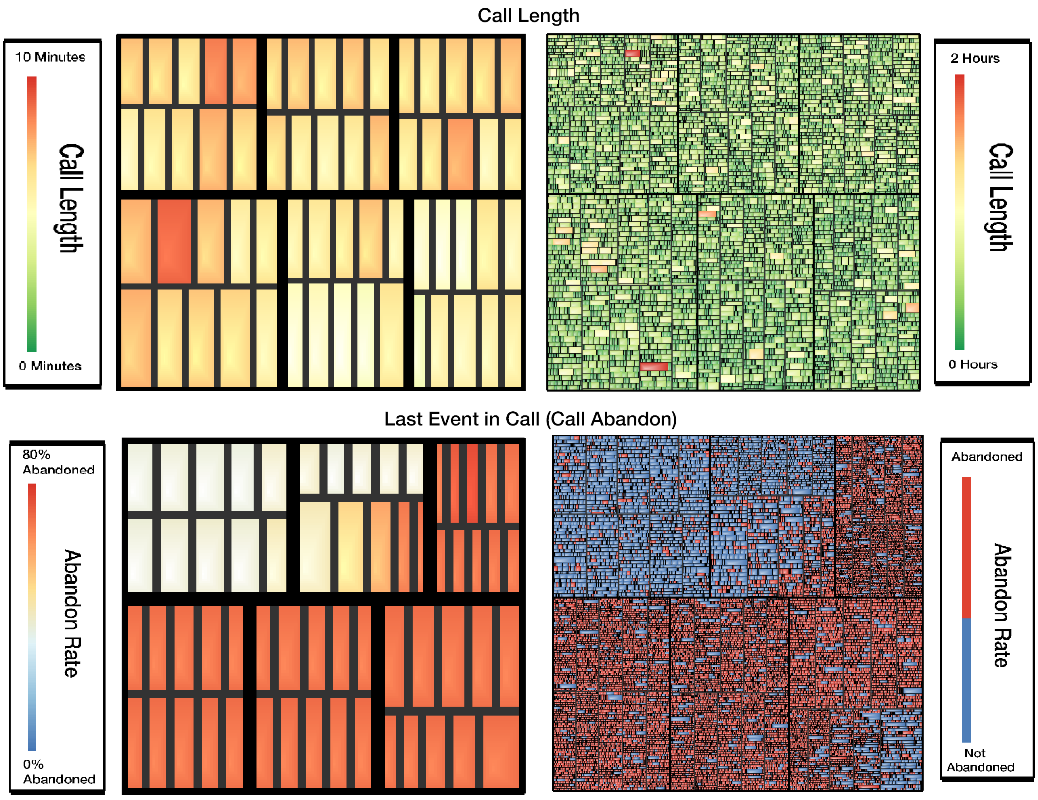

Figure 5: *This figure shows the colour comparison of call length and call abandonment between the two leaf node options. The left images show the leaf nodes as the minute node, and the right images show the leaf nodes as individual call records. The top row shows the data between 18:00 - 19:00 hours and the bottom row visualises 12:00 - 13:00. The last event colour map highlights the increase in call volume from the start of the hour, but also a large increase in abandoned calls very soon after the call was taken. This could potentially be a failure in the recording software, or a failure in the call routing system from the IVR.*

ously using a logical AND operator. Here we list the available call filtering attributes;

- Abandoned Call flag - Filter out abandoned or completed calls.
- Call Type - Inbound, Outbound, Consult calls etc.
- 4 Time based criteria - Call length, time spent in queue, time spent in IVR, and time spent with agent.
- 4 Event based criteria - Total number of events, number of IVR events, number of queue events, and number of agent events.

Due to this multivariate filtering operator, the user can choose to see a very niche subset of calls which helps identify previously unseen patterns in the data. Figure 6 shows examples of our analytical filtering methods;

Part a) shows between hours 19:00 - 20:00 - It visualises callers who waited longer than 15 minutes to talk to an agent and spoke to the agent for less than 15 minutes. These calls are the focus while the others are the context. This has been highlighted by the domain experts as an indicator of dissatisfied customers. A greater number of calls fall within this criteria during the evening, suggesting that queue times are significantly more of an issue in the evening.

Part b) visualises all calls that had more than 5 queue events and spoke to the agent for longer than an hour. The long call does not necessarily result in dissatisfied customers, but there is a higher probability when the number of queue events is high. This small subset of callers are significantly more likely to be dissatisfied with their service and might benefit from a call back to check that the original issue has been resolved in order to retain the customer.

Part c) shows all callers who wait longer than 5 minutes to talk to an agent on the hour between 13:00 - 14:00. The volume of calls does not seem to have risen dramatically over that time and therefore the increased waiting time could be indicative of agents within the call centre taking their lunch break.

Part d) shows all abandoned calls between 13:00 - 14:00. We can observe a dense cluster of abandoned calls between 13:10 - 13:15. This can directly be related to the increased queue time shown in c).

4.7. Detail View

Once the analytical call filters are applied, the user is left with a focus + context call highlighting visualisation. Filtered out calls are given a reduced alpha value so that the focus is placed on calls that remain within the interactive filter bounds. At this stage, trends and patterns can be observed, however individual call event details cannot.

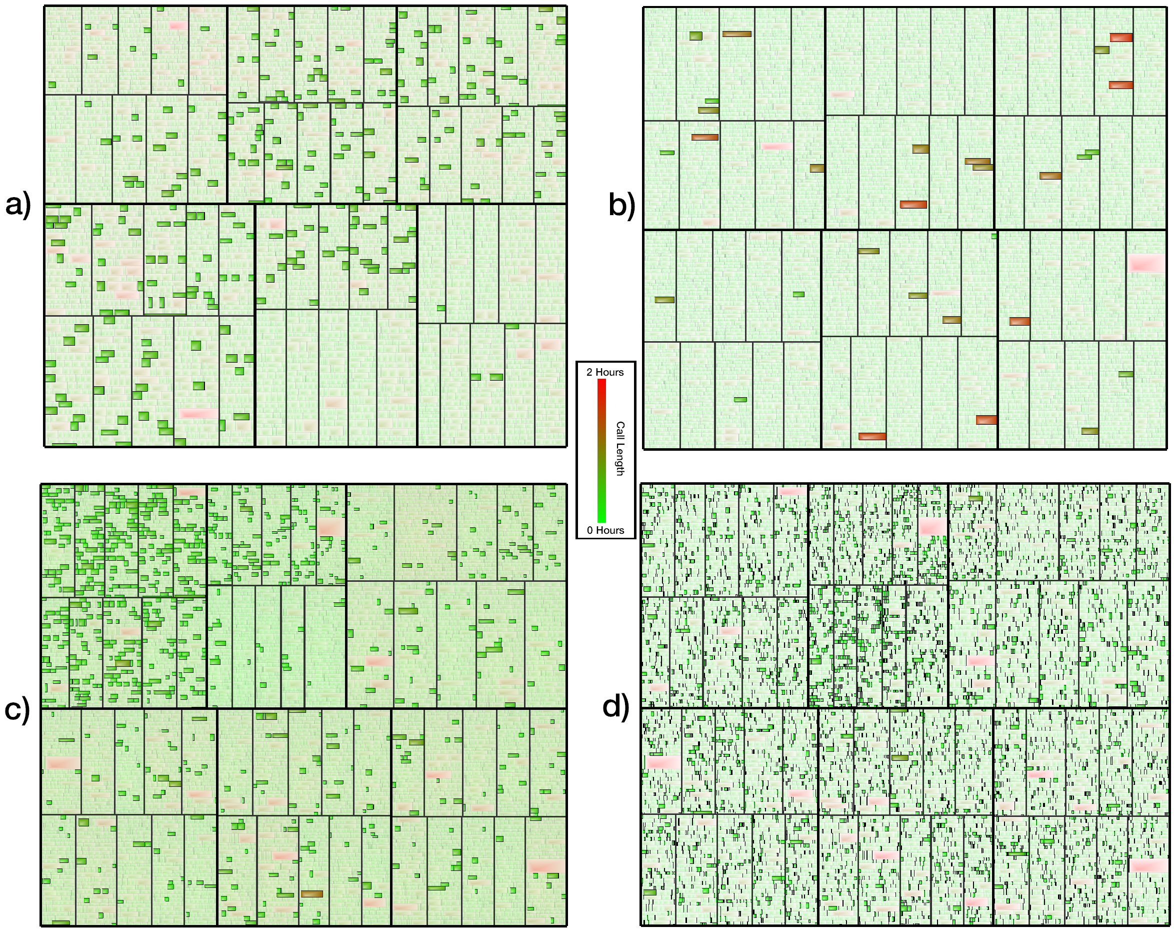

Figure 6: *These images shows the versatile focus + context filtering feature. a) shows callers who waited for at least 15 minutes in the queue but spent less than 15 minutes talking to an agent. b) shows a combination of temporal filtering and event based filtering. c) and d) show a comparison of filters on the same hour. c) is filtering by queue time, and d) filters by abandoned calls. A full explanation of these images can be found in section 4.6.*

If the user enables the 'details' radio button in the user options, the user can hover over the calls to reveal a radial visualisation of the call. Starting at the midnight position, segments of the ellipse depict events in the call. This provides the user with the details of each event in that instance of a call; i.e. if they queued for a large proportion of the call, if they spoke to multiple agents, or if they hung up whilst in the queue.

If the user finds a call that they wish to obtain more details about, they can select the call to bring up a call details window. This window displays the same radial ellipse method of visualising the call, but with extra details such as start and end time (as well as duration), the type of call (internal, outbound, consult etc.), and number of events. See Figure 7.

Multiple call detail boxes can be opened simultaneously to enable a comparison between any calls. A user option also renders events in a uniform manner to reveal any short or zero length events that have been recorded in the database.

The detail view completes the full data scope of the interactive visualisation. The widest resolution view shows a full 24 hours of call centre activity. This resolution can be changed as the user zooms into the data, revealing new levels of information down to the highest level of detail - the individual events within calls.

4.8. Call Activity Observations

To demonstrate the capabilities of the visualisation, we have made some practical observations about the call activity, previously unseen by QPC Ltd.

The first feature in the data highlighted by the visualisation was the significantly higher proportion of callers abandoning their calls during the evening hours, despite the lower volume of calls (see Figure 2). This suggests a staffing level issue within the call centre. It is also apparent that call duration also rises during the evening hours (Compare Figure 1 to (top) to Figure 5).

Figure 1 also shows a highlighted section between minutes 13:15 - 13:20. This highlight shows that the average call duration is very short during that period. Combining this information with the observation that the queue time is significantly longer around that time frame (see Figure 6 c)) we can deduce that the callers may be put

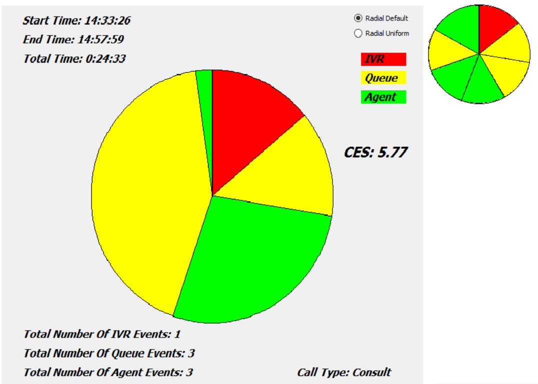

Figure 7: *This shows the radial method for breaking down the call events of a single call. Starting at the midnight position and moving clockwise, the red segment shows the proportion of time spent in the IVR. Yellow events show queue time and green events shows agent time. The right radial plot shows the uniform view whereby each event is drawn as the same size to reveal any zero second events.*

off by the long estimated queue duration (which is typically announced during the call) and then abandoning the call (Figure 6 d)).

Figure 4 (left) shows the average length of calls increases throughout the day with the exception of 09:00 - 10:00. The abandoned rate also increases gradually.

Figure 6 a) shows callers who waited longer than 15 minutes to talk to an agent but then only spoke to that agent for less than 15 minutes. This hour node is reasonably populated with calls of this nature, but most of the other hour nodes leave very few calls in focus with this filter option. This suggests that callers are more willing to wait in a queue during the evening, possibly because it is out of work hours.

4.9. Software Video

Please visit `https://vimeo.com/176731174` for a demonstration video of this visualisation application.

5. Domain Expert Feedback

All of the features were guided by and developed together with Qpc Ltd. We have been collaborating closely since 2014. Because this software is developed for specific decision makers, we report domain expert feedback as part of the evaluation.

We conducted a guided interview with three experienced members of staff at QPC Ltd. After demonstrating the capabilities of the software we asked them to provide feedback. To ensure captured everything they said, we made an audio recording of the interview and later transcribed it to text. The following is a summary of their feedback.

It was said the combination of the analytical treemap and the detail view are very relevant to their research. Having the ability to drill down from the intra-day view into a single call and then be able to break down that call in the detail view is very insightful. To access this data previously, custom SQL queries have to be specially written and the result is simply the entries in the database, not a visual representation of that call.

The smooth zooming and panning features were appreciated as it helped them maintain orientation when using navigating the visualisation.

Another insight for the team was the accuracy of the data. It is known that the data collection service sometimes produces erroneous records, and the visualisation highlights the areas where bad data is created (Figure 5). It makes the software useful and an error detection and correction method in addition to an analysis tool. On the whole it gives the company increased confidence in their data collection methods and analysis.

The experts also commented on the alternative to the visualisation. Any data would previously be examined in table form which is far more difficult to extract meaningful information out of, but also significantly slower. The software abstracts away from the complex nature of the database and simply presents the desired output in an easy to view fashion. The nature of the visualisation engages the user with the data in a far more meaningful way than simple table views.

The twenty four hour colour mapped overview is also a popular feature. The ability to see a minute-by-minute breakdown of the call centre by a range of different metrics would allow previously unnoticed trends in the data to be highlighted. Previous methods of finding these trends visually would involve simple line graphs but offer no further insight into the behaviour behind the trend. As this insight is coupled with the ability to drill down into the data and look at individual call records it is seen as a far more powerful tool.

It is suggested by the domain experts that we continue down our current trajectory by adding more customer centred metrics to the filtering and colouring options. In addition to the filter and colour mapping metrics, the call detail view could be improved by adding more metrics that have recently become available such as caller agent details and call costings for the contact centre.

6. Conclusions and Further work

We plan to continue research into the visualisation of call centre data, and build on our current framework. One avenue we plan to pursue is to create a glyph visualisation based off the detail radial view in this software. We plan to derive a customer effort scoring metric and to see what roles different call events have on the score through the medium of visualisation.

In conclusion, we have created a visual analytics application that presents customer interaction data in a novel and valuable way. The visualisation of this call centre data is a first for the visualisation and business communities. Our contributions of the analytical treemap complete with smooth temporal zooming and panning combined with the advanced, multivariate, analytic filtering have resulted in a practical and demonstrable utility for the industry that has a potential to improve upon business operations and inform management and call-centre decision makers, therefore saving time and money. Our system enables new multi-variate observations to be made and feedback from our partner company is very positive.

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