

Grieving online: the use of search engines in times of grief and bereavement

Ian Ruthven

Department of Computer and Information Sciences
University of Strathclyde
United Kingdom
ir@cis.strath.ac.uk

ABSTRACT

In this paper, we study the information goals in searches on the topic of grieving and bereavement. Using log analyses and content analyses we present a categorization system of grief and bereavement-related queries submitted to a major search engine, reflecting the variety of information needs that occur during a period of bereavement. We also present patterns of interaction during the query formulation stage of these searches and results on the success of searches on the topic of grieving and bereavement. Using linguistic style analyses we compare the content of grief-related queries showing differences in content that may be used to classify grief-related queries to help provide tailored support for different types of query.

Categories and Subject Descriptors

H.3.3 Information Search and Retrieval; J.4 Social and Behavioral Sciences

General Terms

Human Factors

Keywords

Grief, bereavement, query log analysis, information seeking

1. INTRODUCTION

Search engines are important tools in locating information for everyday life situations. Often they can be used to locate information in times of personal crisis: situations in which we are, perhaps unexpectedly, forced to find ways to cope with significant life changes. Such experiences may result in information needs that we have not experienced before or occur when we are least able to deal with complex information requirements.

In this paper, we explore the process of grieving and bereavement, as seen through the lens of queries submitted to a major search engine, to investigate how search engines are used to help with such situations. We examine the major topics of such queries, the success of these queries and patterns of query

formulation within different types of queries relating to grieving and bereavement.

We uncover many information needs that people try to answer during a period of bereavement revealing a range of needs from practical aspects such as planning a funeral, through requesting emotional support, to spiritual concerns and the process of memorializing a loved one.

In section 2 we present several branches of related research, in section 3 we present our methodology for collecting relevant query logs, in section 4 we present our main classification of queries and in sections 5 -7 we present findings on the success of grieving and bereavement-related queries and query behavior. We conclude with discussion on future research and implications in section 8.

2. RELATED RESEARCH

2.1 Lives in Change

Information seeking has long studied the ways in which people seek information for work [13], leisure [16, 19] and for managing everyday life situations [30]. An important aspect of such research is in understanding the processes we use to obtain information and the factors that may lead us to make decisions about how to obtain information. Through studies of information seeking we can learn, for example, about social barriers to obtaining information [12] organizational factors that make some information channels more or less attractive [31], task factors that affect how information problems are resolved [7, 37], or how personal factors shape preferences on how information is sought [24].

Understanding how we resolve information needs, and the methods by which we choose how to resolve these needs, can tell us much about the information needs themselves but also how people make decisions about what information channels are appropriate or useful.

An important branch of information seeking reflects lives-in-change; how people use information to deal with significant life changes and the consequent needs for information which may be new, unexpected and occur when individuals are psychologically vulnerable [1, 2, 35]. These situations are an important topic for information seeking because they often result in different information seeking behavior. As noted by Caplan [7], psychological vulnerability can be caused by an imbalance between the complexity and scale of the life change and the psychological resources available to deal with the life change and its consequences. In a crisis, the same cognitive problem solving

Permission to make digital or hard copies of all or part of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. To copy otherwise, or republish, to post on servers or to redistribute to lists, requires prior specific permission and/or a fee.

IUI, 2012, Nijmegen, The Netherlands.

Copyright 2012 ACM 978-1-4503-1282-0/2012/08...\$15.00.

mechanisms may not be as useful when dealing with a major life change as in everyday life because the same mental resources may not be available or sufficient to deal with the crisis [8, 26]. Therefore the same information seeking skills that we use in everyday life may not be appropriate for obtaining useful information or we may have insufficient psychological resources to deal with problems of the same complexity as we are used to in other situations. However information is usually important in resolving critical life changes and our ability to cope with future crises are also heavily reliant on the ways in which we resolve current crises [8].

Significant life changes, such as redundancy, divorce, major illness or bereavement, can happen multiple times to individuals allowing them to construct ways of coping with the change. However, each will be at some stage a new event and possibly occur unexpectedly. In such situations we have to find ways to cope with the practical requirements of the change, e.g. obtaining a solicitor or doctor, and the emotional and psychological effects of the change. Many of the ways we cope are information-based, either requiring information directly or by using information in order to help deal with the emotional and psychological effects. This is where information systems can help people resolve stages in a crisis and move onto the next stage – helping ‘*people solve problems*’ [4] in situations where they may not recognise all their information needs [4].

As is well known in the medical field, entering a crisis can mean entering an area of life where we have little domain knowledge or knowledge of what questions should be asked. As Johnson points out, ‘*individuals confronted with cancer often find that they must make judgements with an inadequate knowledge base for even understanding basic terminology*’ [22]. In this paper we focus on a specific life change – bereavement – as a case study to question what we can learn about information seeking from analyzing query logs and the types of queries submitted during a period of bereavement.

2.2 Grieving and Bereavement

The processes of bereavement (the loss of someone close) and grieving (the reaction to this loss) are important human processes. They raise important information needs that need short term resolution, including arranging a funeral, and longer-term needs including how to cope with loss and create a new life.

In this study we examine the processes of grieving and bereavement as it is viewed through queries submitted to a major search engine. As search engines become more popular they become more useful and used for human life changes such as bereavement and understanding how they are used and for what purposes can tell us much about what information resources are necessary for those facing loss. Those experiencing a bereavement or period of grieving are usually not under the supervision of healthcare professionals and so will not have information needs identified independently [10].

As Chapple and Ziebland also suggest ‘*bereavement is a time of ... social isolation*’ and those who have been bereaved often seek anonymity, privacy, 24-hour availability of information and avoidance of confrontation when seeking information, all of which could be assumed important in any personal crisis. As use of the Internet becomes more wide-spread, ‘*the culture in which people grieve is evolving*’ and a diverse range of information

seeking has been enabled because of the Internet-mediated communication and information access [10]. Mapping out what types of information needs arise in human processes such as grieving can help us better understand how information and technology providers can respond to these needs.

2.3 Grieving, Bereavement and the Internet

Falconer et al. [17] summarize the range of ways in which the Internet can be used to support grieving and bereavement: from writing memorials [14, 28], using educational resources [15] to engaging with online support groups [3, 9, 20]. Using the Internet as means of support during a period of grieving can have positive aspects, such as emotional and informational support [36], but there are potential negative consequences including online abandonment by those who have provided support [17] and being the subject of targeted abuse [27].

The ease with which news about celebrities can be disseminated through social media has raised interest in how such information channels are used to express and share grief. Goh and Lee [18] studied reactions to Michael Jackson’s death on Twitter using a qualitative coding scheme. Most tweets were sharing news and information but a sizeable proportion of tweets expressed grief. Sanderson and Cheong [29] conducted a similar study on reactions to Jackson’s death on Twitter, TMZ.com, and Facebook demonstrating that different channels offer different possibilities to share and react to grief. Twitter, with a short character limit, for example, was used less often to explore grief than channels such as Facebook.

These two studies explore public grief and reactions to grief. Our study tries to understand the more private aspect of bereavement and grief by examining how search engines are used to gain information on these processes.

2.4 Query log analysis

A transaction log is described by Jansen et al as ‘*an electronic record of interactions between a system and users of that system*’ [21, p2]. The data which users leave behind after using search engines can reveal much about their possible information needs, search behavior and search success [21]. However, a disadvantage is that we have less control and insight into the causes of the queries. Nichols et al describe the content of such logs as being ‘thin’ which means that interpretation must be made by way of inference rather than solid evidence [25]. On the other hand, Jansen et al argue that by adopting a behaviorism approach inner cognitive and contextual factors can also be uncovered through log analysis [21]. Behaviorism in transaction log analysis highlights observable searching behavior but also acknowledges cognitive and contextual features which may be associated with this behavior [21].

Analyzing log data involves studying various measures associated with how the user interacts with the search engine. The search terms submitted to the search engine are fundamental to this process as they are, according to Spink and Jansen, ‘*the basic building blocks through which a Web searcher expresses their information problem*’ [34 p55]. Single or multiple terms form a Web query and from these queries many discoveries can be made by measuring various features of the data [34].

In this study we use the AOL query logs which provides queries and click information from 650 000 users of the AOL search engine over a three month period. The size of the data set means

that we can investigate a potentially wide range of information needs as they are expressed as real queries submitted to a search engine.

3. METHODOLOGY

From the AOL logs we extracted queries that possibly relate to bereavement and grieving in three ways:

1. We extracted all queries that contained stemmed variants of the words *bereavement* and *grief*. We also extracted queries that contain common misspellings of bereavement such as *bereavement* and *bereavement*¹.

2. We extracted queries containing words such as *loss*, *funeral*, *memorial*, *deceased*, and *dying* that might indicate a user who has experienced bereavement.

3. We sampled 0.1% of the logs and manually checked for any additional words or phrases that might indicate a bereavement related query. We then extracted all queries that also contained these words.

This approach will miss queries that are inspired by a period of bereavement but which give no textual indication that the query is motivated by the consequences of grief, e.g. the query *I am unhappy* may be a query for help that is motivated by unhappiness caused by grief but the query itself does not give any clue to the source of the unhappiness. Consequently we will have underestimated the number of queries that are inspired by grief but have retained queries that explicitly indicate a grief or bereavement related information need.

From this target set of queries we removed queries which were clearly not about bereavement of grief caused by a death, e.g. queries about grievances or about grief due to loss of a waistline. We also removed queries that were about celebrity deaths and funerals (of which there were a lot) and queries which focused on education, e.g. queries on courses to become funeral directors, and queries that appeared to be professional enquiries, e.g. queries on wholesale funeral caskets. We also removed queries about the process of dying, caring for the dying and planning a death in order to focus specifically on grieving.

This gave rise to a set of 7528 queries, from 2105 users, who issued at least one query related to the process of grieving and bereavement. Out of the 7528 queries there were 2564 unique queries and the distribution appears to approximate a power law distribution.

We use this query set to examine four major research questions:

- What topics are commonly expressed as queries to AOL during a period of bereavement, section 4.
- Are some topics more successfully answered by search engines than others, section 5.
- How are grief related topics issued within search sessions, section 6.
- Are there differences in linguistic style between different categories of query, section 7

¹ <http://how-to-spell.net/bereavement>

4. CLASSIFICATION OF GRIEF RELATED TOPICS

In this section we present a classification of queries based on qualitative content analysis. Content analysis involves making the content of messages manifest through identification of characteristics in as objective a way as possible [6]. The intention is to create a coding schema, or ‘membership categorisation device’, which encompasses a collection of categories and a set of rules on how to attribute data to these categories [31, p.379]. The schema was developed iteratively by looking at the data, identifying possible categories and then testing these on further data to see if they can be applied in their current form.

The initial classification scheme was developed using a 10% sample of the data. A cross-coder reliability test was run on a separate sample of 5% of the data revealing an 85% agreement between two independent coders. The areas of disagreement were discussed and resulted in a tightening of the initial categories. Once the scheme had stabilized we applied the coding scheme to the full data set. In some cases it was difficult to determine in which category the query should be classified. In such cases we try to resolve the classification contextually either by running the query on current search engines or, if the query resulted in any clicks, using the WayBack Machine² to see the content of the pages as seen by the original searcher. For a relatively small number of queries we were unable to classify them based on the information available.

The result of the classification process is a set of 6 main categories (not including the **Unclassified** category) and 19 sub-categories.

In Table 1 we present a numerical breakdown of the distribution of queries from our sample that was assigned to each category and sub-category. Specifically, we present the number of unique queries in each sub-category, the percentage of unique queries in each sub-category, the total number of unique users who issued at least one query within the sub-category, and the total number and percentage of all queries that were contained within the sub-category.

The categories and sub-categories reflect the main topic of the query. The exception is the **People, Pets and Groups** category which contain queries in which the main topic is a person, group or animal, and also queries in which people, groups or animals, are modifiers to a query, e.g. *poem for a dead mother*. This category will be discussed in more detail in section 4.5. Categories and sub-categories are not discrete: queries may appear in more than one category, e.g. the query *which country and western songs are suitable for funerals* is looking for songs but the information is required for *planning a funeral*. Similarly, the query *how to cope with the loss of a cat* is looking for information on how to cope with bereavement but information that is specifically tailored for pet bereavement.

The percentage of of unique queries and the percentage of total queries was highly correlated ($p=0.94$) indicating that no category had a significantly higher rate of unique queries.

In the following sections we break down these categories in more detail, explaining what type of queries was contained in each category and how the categories differed.

² web.archive.org/

Table 1. Query distribution over identified categories. Bold figures indicate total for each sub-category.

Category	Sub-category	Unique queries	%age of unique queries	Unique users	Total queries	%age of total queries
Beliefs	afterlife	41	1.28%	64	155	1.65%
Resources	poem/book/lyrics	383	11.98%	332	1516	16.14%
	grief resources	142	4.44%	97	336	3.58%
	sub-total	525	16.42%	429	1852	19.72%
Financial and legal	financial	226	7.07%	163	523	5.57%
	legal	135	4.22%	203	431	4.59%
	sub-total	361	11.29%	366	954	10.16%
Process of grieving	effects of grief	90	2.82%	69	242	2.58%
	treatment	90	2.82%	74	225	2.40%
	stages of grief	33	1.03%	57	189	2.01%
	definition	21	0.66%	80	286	3.05%
	preparing for grief	20	0.63%	14	39	0.42%
	types of grief	8	0.25%	8	12	0.13%
		sub-total	262	8.21%	302	993
Rituals and behaviour	funeral homes	500	15.64%	501	999	10.64%
	planning for a funeral	478	14.96%	419	1541	16.41%
	etiquette	173	5.41%	144	418	4.45%
	rituals	85	2.66%	74	207	2.20%
	memorials	77	2.41%	71	220	2.34%
	sub-total	1313	41.08%	1209	3385	36.04%
People, pets and groups	who has died	365	11.42%	233	1122	11.95%
	specific groups	178	5.57%	135	513	5.46%
	pets	128	4.01%	95	361	3.84%
	sub-total	671	20.99%	463	1996	21.25%

4.1 Beliefs

A small group of queries (1.28% of unique queries) were on the afterlife, considering the possibility of life after death. Due to the small number of queries we did not try to refine this category further and used the general concept of **Beliefs** to express beliefs in the spirit communication and life after death.

1. **Afterlife.** Such queries were about the afterlife, questioning whether the afterlife exists, how to contact the dead and asking about specific supernatural phenomena. Approximately one third of these queries specifically asked about pets.

4.2 Resources

Often people require support during periods of bereavement. This can come in several forms; emotional, practical, spiritual, financial, and can come from different sources. In this category we present two main axes of support that were common within the query logs: support in the form of artistic works (**Poems/book/lyrics**) that provide support in the form of literature, poetry, prayers and songs and support in the form of resources such as grief centers (**Grief resources**). Almost 20% of total queries were on this topic making it one of the largest categories of queries in our sample.

1. **Poems/book/lyrics** queries specifically ask about poetry, song lyrics, non educational books and spiritual material. Only a small number of these queries (about 4%) were associated with selecting material for a funeral, the majority did not have this association and appeared not to be associated with funeral. Aside from **Planning a funeral** this sub-category had the highest number of total queries and reflected a wide range of needs from

very general (e.g. *songs for funerals*) to very specific (e.g. *a sympathy poem for my son's death*). Specific queries were far more common than general ones reflecting perhaps the need to have a very personal response to the work. Queries in this category also showed a range of situations in which artistic works might be useful from acting as gifts to the bereaved, to works that might support a transition in grief to works that were memorial in nature, e.g. *poems for the anniversary of a death*. Queries in this sub-category also display the need for spiritual works such as prayers and religious works that are often important during times of bereavement [11].

2. **Grief resources** request information on sources of emotional support during a period of bereavement. The majority of queries are for grief counseling centers or grief support groups. Only a very small number were seeking online support. Queries that were requesting educational resources, e.g. courses in grief support or bibliographies on grief resources, were excluded as it was not possible to tell whether these queries came from searchers who had a professional or personal interest.

4.3 Financial and Legal

Bereavement can give rise to many financial and legal questions, some of which may be simple but many of which may be complex. This was the only category in which we saw statements of a situation, e.g. *my uncle intended for me to have the house and then he died*, rather than stating a topic or posing a question. In such cases, it may be that the searcher cannot define a question and states his/her situation in the hope that it matches useful pages. Most queries in this category have some legal implications but we separate out queries that are specifically about financial matters, e.g. credit card debts of the deceased, due to the large

number of queries that were about finance. Approximately 10% of all queries were contained within this category.

1. **Financial.** Queries about the financial implications of a death were common. Queries in this category specifically mentioned financial terms such as taxes, credit card debt, and fees. Such queries ranged over a number of topics including financial implications of organizing a funeral, financial support for travelling to a funeral (especially reduced rates on airlines) and insurance claims.

2. **Legal.** Queries classified as legal concerned legal implications, often documentary, arising from a death. Common queries were on how to obtain death certificates, how to deal with transfer of legal documents such as share certificates and queries about legal status and queries surrounding death notices. The most common query in our sample was obtaining death certificates; we excluded all queries that appeared to be from genealogists rather than those who were trying to obtain a death certificate but this need for important documentation still gave rise to many queries.

4.4 Processing of grieving

The experience of bereavement and grief often gives rise to the need to understand the experience. Queries in this category express the need to understand what grief and bereavement means (**Definition**), to look forward to what to expect once a bereavement occurs (**Preparing for grief**), to learn about different types of grief (**Types of grief**), to learn more about the effects or possible effects of grief (**Effects of grief**) and how to cope with grief (**Treatment**). Approximately 10% of all queries were contained within this category.

1. **Definition.** This category includes queries that ask for some definition of grief or explanation of what grief means. It includes the most common query, the single query *grief*.

2. **Preparing for grief** where the query expresses that the person is looking towards a bereavement that will occur. It does not include queries about the process of dying or the care of someone who is dying, Section 3. Rather it includes queries that recognize that knowledge that the process of grieving may start before a bereavement occurs.

3. **Types of grief** where the query asks about a specific type of grief such as *unresolved grief* or *repressed grief*.

4. **Stages of grief** where the query explicitly mentions Elizabeth Kübler-Ross's model of the stages of grief, often referred to as the 5 stages of grief [23]. Queries will either refer generally to *stages of grief*, the *5 stages of grief* or the later *7 stage grief* model.

5. **Treatment** where the query asks about treatment for grief or is about coping with grief. **Treatment** as a category could overlap with **Grief resources**. However, in **Grief resources** the resource being sought is expressed within the query itself. In **Treatment** there is no indication of what type of support is required, rather the query generally expresses, through the use of words such as *coping*, *handling*, or *dealing with*, the desire for information to help with the process of grieving.

6. **Effects of grief** where the query expresses some effect of grief which may be *psychological*, e.g. memory loss following a bereavement, *physical*, e.g. increased risk of cancer following bereavement, or *emotional*, e.g. anger during bereavement. A small number of queries asked for information about the effects of grief within a marriage.

4.5 Rituals and Behaviors

The single largest category of queries in our sample (36% of all queries and 41% of unique queries) was focused on behaviors and rituals. This category contains queries on how individuals should behave towards others (**Etiquette**), how individuals should act in order to remember the deceased (**Memorials**), how to understand the behavior and beliefs of others (**Rituals**) and how to organize the major ritual associated with a death (**Planning a funeral** and finding **Funeral homes**). Rituals, funerals and individual behavior are considered together as rituals are often behavior-oriented, expressing social norms of behavior and queries on organizing a funeral often reflect the desire to behave appropriately.

1. **Etiquette.** Here the query expresses a need for information on how to behave, e.g. whether or not to send flowers to a funeral, how to speak to a bereaved person, how to dress at a funeral, how to write a condolence letter, etc. Queries in this category mostly focus on appropriate forms of behaviors during someone else's bereavement. Queries about how etiquette relating to *organizing* a funeral, e.g. *what is the correct order for listing family members in an obituary*, are categorized under **Planning a Funeral**.

2. **Rituals.** Here the query is about some kind of ritual associated with bereavement and grieving but not specifically attending or planning a funeral. Of course funerals themselves are heavily ritualized events and customs may vary according to the community involved. Queries in this category either reflect the need to understand a community's traditions (e.g. *what are Jehovah's witnesses funerals like*) which may share with **Etiquette** the need to understand how to behave or which seek to use a community's wisdom to support a period of bereavement, e.g. *prayers at the death of a father*. The latter group may fall under the category **Grief Resources** but have been retained under this category as they involve a religious dimension more commonly associated with ritual.

3. **Planning a funeral.** Queries in this category indicate that a funeral is being planned rather than being attended. There are a high number of unique queries in this category indicating the amount of reflection and decision-making that goes into a organizing a funeral. Queries in this category reflect several groups of decisions: decisions on **resources** (selecting flowers, selecting caskets, sourcing printers for funeral programs); decisions on how to **behave** (how to dress, what food to serve, what jewelry to wear); and many decisions on **speech acts** (how to speak to guests, how to create a eulogy, what readings are appropriate). This category contained the largest number of queries in our categorization system.

4. **Funeral homes.** Here the query is about selecting a funeral home to organize a funeral. We excluded queries about specific funeral homes which appeared directional and only retained queries that were about the action of selecting a funeral home. Conceptually selecting a funeral home is part of **Planning a Funeral** but we separated out this category due to the large number of queries involved in this task. Queries relating to the task of finding a funeral home were the single most common source of unique queries due to the usually very precise geographic restrictions contained within the query, e.g. *funeral home cresco iowa*.

5. **Memorial** queries are ones where the query is about the process of creating a memorial to someone who has died. Queries

relating to memorials planned as part of a funeral, e.g. choosing a memorial urn, were classified under **Planning a funeral**. This category contains queries that related to activities not directly associated with funerals but which express the desire to form a permanent memorial to the deceased, e.g. planting a tree, ideas for memorial tattoos, and ideas on what types of gifts it is appropriate to give to someone who is bereaved as a memorial. Queries surrounding the death of a child were common in this group including queries on how to appropriately memorialize a lost child.

4.6 People, pets and groups

20% of queries in our sample mention who had died. 23% of queries in this category only mention that someone has died, e.g. *grieving the loss of a wife* with no further indication of what information is required. More commonly, queries are made more specific by the inclusion of the person who has died, e.g. *poem for a lost son, how to help children who have lost a parent, funeral for my mother*. As such, this category generally does not reflect the topic of an information need; rather the entries make the query more precise. However it is an important category due to the specific nature of the information that is required.

1. **Who has died** where the query mentions the person who has died, e.g. my mother, my husband, her child.

2. **Specific groups** where the query is about grief in an identified group, e.g. Native Americans, African Americans, military, or grief in a known individual, e.g. *my husband is grieving his mother*. Originally we separated queries which sought information on generic group, e.g. Buddhists, from known individuals. However these sub-categories were combined due to the low level of queries in the second group and the difficulty of clearly discriminating between the sub-categories.

3. **Pets** where the query refers to that the fact that a pet has died. Pet queries often specify important differences (e.g. looking for a pet cemetery or writing a condolence letter to someone who has lost a pet) or seek for specific advice about grieving for a pet rather than a human. Almost 4% of queries were explicitly about pets demonstrating the value of non-human relationships and the effect of their loss.

4.7 Unclassified

After the final classification there remained a small number of queries, less than 1% of the total, which could not be classified.

5. SUCCESS OF QUERIES

In Table 2 we present the success rate of queries within each category. A successful query was defined as one in which at least one search result was clicked. This obviously does not inform as to the quality of the information obtained but does inform as to the attractiveness of the search results obtained. As can be seen, legal queries had the lowest success rate of the categories identified in section 4. These queries appeared to have a low success rate due to the lack of precision within the queries (e.g. unsuccessful queries were often followed by a geographically more precise query) and common spelling mistakes on query terms such as *certificate*. Similarly, queries in the sub-category of **Funeral homes** often required to be modified to become more geographically specific.

Table 2. Success of queries

Category	% of successful queries
legal	53.47%
funeral homes	60.80%
financial	64.89%
grief resources	66.86%
preparing for grief	72.50%
rituals	72.60%
planning for a funeral	73.45%
definition	73.52%
afterlife	73.72%
etiquette	73.99%
effects of grief	75.31%
who has died	75.95%
specific groups	77.82%
treatment	77.88%
pets	80.16%
memorials	83.26%
types of grief	84.62%
poem/book/lyrics	84.99%
stages of grief	93.12%

6. SESSION BEHAVIOUR

We examined user sessions in more detail to uncover how grief related queries occur within search sessions: do they occur in dedicated sessions relating to grief and bereavement or do they intermingle with queries on other topics?

We randomly selected 5% of the queries in our analysis set which occurred in multiple-query session, each from a different searcher, and classified the sessions into four categories:

1. **Discrete**: where the grief-related session was a discrete session, i.e. no queries on any other topic were issued within the same session.
2. **Grief-first**: where the grief-related session was the first part of the session and the user then switched to another topic
3. **Grief-last**: where the session started on one topic and then switched to grief related topic.
4. **Mixed**: where grief related topics were mixed within a session on other topics.

Table 3. Session behaviour

	Sessions
Discrete	64%
Grief-first	17%
Grief-last	5%
Mixed	14%

As we can see these grief-related searches were most commonly conducted within discrete sessions dedicated to these topics. 81% of sessions that contained a grief-related query were sessions in which the first query was a grief-related query (combining the discrete sessions and the grief-first sessions) indicating that these needs promote a period of online searching rather than occur whilst in the midst of online searching, i.e. the information needs behind these queries cause the searcher to start searching rather than lead on from other information needs.

Given the longitudinal nature of the query logs, spanning a three month period, we expected that we might see ‘arcs’ of grief where grief and bereavement information needs developed over time. However we did not observe this. When we started examining the sessions in more detail, concentrating on those searchers who issued queries over the three month period, we did not see queries from individual searchers that spanned across the categories outlined in section 4. Rather what we saw was that individual searchers tended to issue queries from a small range of the categories outlined in section 4: some searchers tended to issue factual based queries (e.g. around funerals and financial matters) whereas other searchers issued queries around support (e.g. grief resources or poems/books/lyrics).

The use of search engines therefore appeared not to be used as a general resource for information but individual searchers used it for certain types of support and information. This could be either because individual searchers only lacked certain types of information or that they only viewed search engines as useful for answering certain types of information need. Naturally the log analyses cannot tell us why this behavior occurred but the lack of diverse information needs from individual searchers seems interesting for future analyses.

Query modification was also not common. Aside from modifying queries to make them more geographically precise, as explained in section 4.5, and to correct spelling mistakes, queries were only modified to make them more precise, particularly to add information on who has died.

7. LINGUISTIC CONTENT

We then analyzed the linguistic and sentiment content of queries using the Language Inquiry Word Count³ package. This dictionary based application provides a score between 1 and 100 for various linguistic categories expressing the proportion of words in the sample text that are contained within the dictionaries for each category. In our case the sample texts are the queries for each sub-category identified in section 4.

We use the basic LWIC analysis to examine the proportion of *self-references* (uses of the words ‘I’, ‘me’, ‘my’) that often reflect a more honest state but can also indicate someone who is depressed [31]; the proportion of *social words*, words that are more outward facing and reflect a higher degree of social connectedness; the proportion of *positive* and *negative* emotions; the proportion of *cognitive words* that reflect the degree to which people are thinking about their topic and the proportion of *Big words* which have more than 6 letters. The proportion of Big words can indicate a less emotional and more detached state. Similar analyses have been conducted on other grief-related resources, e.g. in [6] the analyses were conducted on messages posted on the pages of deceased MySpace users. The results of this analysis are shown in Table 4.

Even though queries are often short it is still possible to see patterns arising from the LWIC analysis: queries in the sub-category **Etiquette**, for example, reflect more social thinking, have a high use of cognitive words (people are thinking about how to behave) and a high use of Big words reflecting a need that is less emotionally charged. In contrast queries in the sub-category **Effects of grief** are more characterized by a higher use of negative emotions and low use of Big words.

The highest use of self-referencing words occurred in queries relating to the **Afterlife**, **Preparing for grief**, the **Effects of grief** and **Financial** matters. The queries in the category **Afterlife** score highly because of the high correlation with Pets (e.g. my cat) and the queries in the **Financial** sub-category score highly because of many queries that were expressed as questions (e.g. how can I obtain...), whereas the other sub-categories express reflections on a personal state. The lowest used of self-referencing words occurred in queries that reflected more neutral, factual information needs such as those on the **Stages of grief**, **Types of grief**, **Legal issues** and queries that are primarily about other people (e.g. **Rituals**, **Specific groups**).

The highest proportion of social words occurred in queries in sub-categories such as **Etiquette**, **Memorials**, **Specific groups** which are focused on other people and lowest in **Stages of grief**, **Types of grief**, **Funeral homes** and **Legal** sub-categories which are less people-centered and more focused on obtaining factual information.

Examining the use of sentiment words we find the highest use of negative emotions in the **Types of grief** (where types of grief are classified by words such as *repressed* that are already negative in sentiment), **Definition** and **Stages of Grief** (because of the negative connotation of words such as grief and bereavement) and **Who has died** and the lowest use of negative emotions in categories such as **Afterlife**, **Planning a funeral**, **Funeral homes**, and **Financial** which are more factual in nature.

The highest use of positive emotional words occurs in sub-categories such as **Grief resources** and **Preparing for grief** (expressed through words such as coping which express the desire to improve their position) and the lowest use of positive words in queries such as **Definitions**, **Stages of grief** and **Types of grief** as these queries are usually classified as emotionally negative.

The highest rate of cognitive words were used for queries in the sub-categories reflecting **Types of grief** and **Treatment**. As noted above, **Treatment**, unlike **Grief resources**, is a category where the searcher is looking for support but does not/cannot express how that support should be provided. The high rate of cognitive words suggests that this category does reflect a set of information needs about which the searcher may be struggling to form into a query. The lowest rate of cognitive words was seen in **Grief resources** (where the searcher can express what type of support they require), **Funeral homes** and **Who has died**. In the latter two cases the queries are generally simple, especially in the case of **Funeral homes**.

The highest rate of Big words occurred in sub-categories **Planning a funeral**, **Legal**, and **Funeral homes**. The high score for Funeral homes was due to the geographical restrictions in many of these queries. The high score for the other two sub-categories may reflect a more practical, and less emotional, frame of mind when searching for these information needs. The lowest use of Big Words occurred in the sub-categories **Effects of grief** and **Pets**, both of which were (negative) emotionally charged categories.

Differences in the use of types of words, even in short queries, open up the possibility of classifying the queries, using a categorization system such as the one described in section 4,

³ <http://www.liwc.net/>

Table 4. LWIC analysis of queries

Category	Sub-category	Self-references	Social words	Positive emotions	Negative emotions	Overall cognitive words	Big words (> 6 letters)
Beliefs	afterlife	4.08	15.51	2.45	0	4.49	21.63
Resources	poem/book/lyrics	0.84	9.52	3.11	6.95	0.72	16.23
	grief resources	0.54	13.57	6.25	15.36	0.18	38.07
Financial and legal	financial	1.62	5.88	2.55	0.85	3.09	31.71
	legal	0	1.14	0.38	1.14	1.33	40.15
Process of grieving	effects of grief	1.58	11.76	1.36	12.22	5.43	1.58
	treatment	0.2	10.59	1.02	10.18	5.5	17.92
	stages of grief	0	0	0	22.63	0.73	21.17
	definition	0	2.82	0	18.31	7.04	25.35
	preparing for grief	2.06	9.28	6.19	4.12	4.12	20.62
	types of grief	0	0	0	50	8.33	29.17
Rituals and behaviour	funeral homes	0.14	0.36	0.27	0.05	0.05	41.72
	planning for a funeral	0.15	3.65	2.98	0.22	2.6	53.5
	etiquette	0.68	15.7	3.19	2.96	5.01	23.89
	rituals	0	3.98	1.77	2.21	4.42	32.74
	memorials	0.4	14.57	2.02	6.88	0.81	31.58
People, pets and groups	who has died	0.61	24.39	2.25	14.96	0.2	19.67
	specific groups	0	13.66	1.09	7.65	2.73	38.07
	pets	0	1.66	0.55	13.81	2.21	14.36

8. DISCUSSION

In this paper, we reported on the development of a coding system for classifying queries relating to the processes of grieving and bereavement. Such approaches can inform on what was submitted to search engines, the queries themselves, but cannot inform on other contextual aspects. However the query submitted is the only information that search engines have to decide on appropriate results so analyzing the queries is an appropriate method of investigating how information needs are presented to search engines. Using this categorization system we classified queries submitted to the AOL search engine to examine what types of queries are submitted, initially concentrating on the topics of the queries, followed by an examination of the linguistic style of the queries and how the queries fit into sessions of searching.

Our study revealed the variety of queries which may arise during a period of bereavement, that individuals vary in how they use search engines for information needs related to grieving and that different categories of queries are differentiated by the use of linguistic features. As the same information need may be expressed differently depending on the emotional state of the searcher such linguistic cues may indicate how search engines may support the searcher by the types of information presented.

Obtaining information through search engines is only one method by which we might obtain information and, as indicated by the distribution of queries across the categorization system, queries that target factual information are popular queries for answering by search engines. As we noted in section 2 grieving and bereavement are processes where searchers may have limited abilities to effectively express their information need and it is perhaps not surprisingly that certain types queries are common.

Queries on finding a funeral home or planning a funeral are perhaps easier to express as a query, whereas more complex needs that cannot easily be expressed may be targeted to other kinds of resource, such as chatrooms [19]. Queries that target certain types of emotional support, such as poetry and literature, were also common and these queries are also easy to create during a stressful period.

A common feature was the need to personalize the query to the person who had died suggesting an appropriate support for searchers would be query suggestions that are more tailored to the person who has been lost. The analysis in section 6.1 indicates that grief-related queries typically occur in dedicated sessions which could provide rich evidence to allow such personalization.

The analysis of searcher behavior also showed that individual searchers tend to only issue queries from a narrow range of categories rather than using search engines to target a wide range of support. It may be useful therefore to suggest other kinds of support that are available, e.g. if someone is searching for funeral homes, it may be useful to recommend searches on Grief resources that are available as such resources may not be obvious to someone who is in a vulnerable state.

In this paper we focused on search engines, complementing other work on other forms of information seeking activity, e.g. [19], that may occur during a period of bereavement. By understanding information seeking within a particular activity we can hope to better understand the needs faced by people and how we can better support answering those needs.

9. REFERENCES

- [1] Andreassen, S., Randers, I., Näslunde, E., Stockeld, D. and Mattiasson, A.-C. 2005. Family members' experiences,

- information needs and information seeking in relation to living with a patient with oesophageal cancer. *European Journal of Cancer Care*. 14. 426-434.
- [2] Baker, L.M. 1998. Sense making in multiple sclerosis: the information needs of people during an acute exacerbation. *Qualitative Health Research*. 8. 1. 106-120.
- [3] Barak, A., Boniel-Nissim, M., & Suler, J. 2008. Fostering empowerment in online support groups. *Computers in Human Behavior*. 24. 1867-1888.
- [4] Belkin, N. J. 1980. Anomalous States of Knowledge as a Basis for Information Retrieval. *Canadian Journal of Information and Library Science*. 5. 133-143.
- [5] Brubaker, J. R., Kivran-Swain, F., Taber, T., Hayes, G. R. 2012. Grief-Stricken in a Crowd: The Language of Bereavement and Distress in Social Media. Sixth International AAAI Conference on Weblogs and Social Media.
- [6] Bryman, A. 2008. *Social Research Methods*. Oxford University Press.
- [7] Byström, K. & Järvelin, K. 1995. Task complexity affects information seeking and use. *Information Processing & Management*. 31. 2. 191-213
- [8] Caplan, G. 1964. *Principles of Preventive Psychiatry*. Great Britain: Tavistock Publications.
- [9] Capitulo, K. L. 2000. Perinatal grief online. *The American Journal of Maternal/Child Nursing*. 29.5. 305-311.
- [10] Chapple, A. and Ziebland, S. 2011. How the Internet is changing the experience of Bereavement by Suicide: A Qualitative study in the UK. *Health*. 15. 2. 173-187.
- [11] Chapple, A., Swift, C and Ziebland, S. 2011. The role of spirituality and religion for those bereaved due to a traumatic death. *Mortality*. 16 1. 1-19
- [12] Chatman, E. A. 1996. The impoverished life-world of outsiders. *Journal of the American Society for Information Science*. 47.3.193-206.
- [13] Choo, C. W., Detlor, B. and Turnbull, D. 1999. *Web Work: Information Seeking and Knowledge Work on the World Wide Web*. Kluwer Academic Press.
- [14] De Vries, B. and Rutherford, J. 2004. Memorializing loved ones on the world wide web. *Omega Journal of Death and Dying*. 4. 1. 5-26.
- [15] Dyer, K. A., & Thompson, C. D. (2000). Internet use for web-education on the overlooked areas of grief and loss. *Cyber Psychology & Behavior*. 3. 2. 255-270.
- [16] Elswailer, D., Mandl, S. and Kirkegaard Lunn, B. 2010. Understanding casual-leisure information needs: a diary study in the context of television viewing . *Proceeding of the third symposium on Information interaction in context*.
- [17] Falconer, K., Gibson, K., Norman, H., and Sachsenweger, M. 2011. *Grieving in the Internet Age*. Penn Medicine: Center for Cognitive Therapy. http://works.bepress.com/penn_cct/1
- [18] Goh, D. H.-L., and Lee, C. S. 2011. Analysis of tweets in response to the death of Michael Jackson, *Aslib Proceedings*. 63. 5.432 – 444.
- [19] Hartel, J. 2010. Time as a framework for information science: Insights from the hobby of gourmet cooking.. *Information Research*. 15. 4.
- [20] Hasler, L. And Ruthven, I. *Escaping Information Poverty through Internet Newsgroups*. 2011. *Proceedings of the Fifth International AAAI Conference on Weblogs and Social Media ICWSM-11*.153-160.
- [21] Jansen, B. J., Spink, A. and Taksa, I. (eds). 2009. *Handbook of Research on Web Log Analysis*. Idea Group Inc (IGI).
- [22] Johnson, J. D. 1997. *Cancer Related Information Seeking*. United States of America: Hampton Press, Inc.
- [23] Kübler-Ross, E. 1969. *On Death and Dying*, Routledge.
- [24] Morris, M. R., Teevan, J., and Panovich, K. 2010. What do people ask their social networks, and why?: a survey study of status message q&a behavior. *Proceedings of the 28th international conference on Human factors in computing systems (CHI '10)*. 1739-1748.
- [25] Nicholas, D., Huntington, P., Lievesley, N. and Withey, R. 1999. *Cracking the Code*. Online & CD ROM Review. 23.5. 263-269.
- [26] Niven, N. 2000. *Health Psychology for Health Care Professionals*. 2nd edition. Harcourt Publishers Limited.
- [27] Philips, W. 2011. LOLing at tragedy: Facebook trolls, memorial pages and resistance to grief online. *First Monday*. 16. 12–5
- [28] Roberts, P. 2004. *Here Today and Cyberspace Tomorrow: Memorials and Bereavement Support on the Web*. 2004. *Generations*. 28. 2. 41-46.
- [29] Sanderson, J. & Cheong, P.H. 2010. Tweeting Prayers and Communicating Grief over Michael Jackson Online. *Bulletin of Science, Technology and Society*. 30. 5., 328-340.
- [30] Savolainen, R. 2008 *Everyday information practices: a social phenomenological perspective*. Scarecrow Press
- [31] Silverman, D. 2005. *Doing qualitative research: a practical handbook*. SAGE.
- [32] Slatcher, R.B., Chung, C.K., Pennebaker, J. W., and Stone, L. D. (2007). Winning words: Individual differences in linguistic style among U.S. presidential and vice presidential candidates. *Journal of Research in Personality*. 41. 1. 63-75
- [33] P Ruma Spence and Reddy, M. C. 2007. The "active" gatekeeper in collaborative information seeking activities. In *Proceedings of the 2007 international ACM conference on Supporting Group Work (GROUP '07)*. 277-280.
- [34] Spink, A. and Jansen, B. J., 2004. *Web Search: Public Searching of the Web*. Berlin: Springer–Verlag.
- [35] Steenbergen Richmond, L. & Hendrickson Christensen, D. 2001. Coping Strategies and Postdivorce Health Outcomes. *Journal of Divorce & Remarriage*. 34. 1-2. 41-59
- [36] Swartwood, R. M., McCarthy Veach, P., Kuhne, J., Lee, H. K., and Ji. K. 2011. Surviving Grief: An Analysis of the Exchange of Hope in Online Grief Communities. *OMEGA-- Journal of Death and Dying*. 161-181.
- [37] Tombros, A., Ruthven, I. and Jose, J., How users assess web pages for information-seeking. *Journal of the American Society for Information Science and Technology*. 56. 4. 327-34.