



ILHAIRE
INCORPORATING LAUGHTER INTO HUMAN-AVATAR
INTERACTIONS: RESEARCH AND EVALUATION

MONO-CULTURAL DATABASE OF HILARIOUS LAUGHTER DELIVERABLE 1.3

PROJECT FP7-ICT
GRANT N°270780

Version 1.5
15 March 2013

Programme Name:	FP7 - ICT
Project Number:	270780
Project Title:	ILHAIRE
Partners:	University of Mons (Belgium – Coordinator), Centre National de la Recherche Scientifique (France), Universtaet Augsburg (Germany), Universita Degli Studi Di Genova (Italy), University College London (United Kingdom), The Queen’s University of Belfast (United Kingdom), Universitaet Zuerich (Switzerland), Ecole Supérieure d’Electricité (France), La Cantoche Production SA (France)
Document Number:	Ilhaire.WP1.QUB.D1.3
Work-Package:	WP1
Deliverable Type:	Other
Contractual Date of Delivery:	28 February 2013
Actual Date of Delivery:	15 March 2013
Title of Document:	Mono-Cultural database of hilarious laughter
Author(s):	Will Curran, Gary McKeown
Reviewers(s):	Jérôme Urbain , Gualtiero Volpe, Olivier Pietquin
Approval of this report:	15 March 2013
Summary of this report:	-
History:	Version 1.0 on 27/02/2013. Reviews received on 28/02, 03/03 and 11/03. Final version 1.5 on 15/03/2013
Keyword List:	-
Availability	This report is: Public

TABLE OF CONTENTS

1. Executive Summary	1
2. Introduction.	2
3. Laughter Induction Techniques in Task 1.6	2
a. Laughter-Induction Techniques Developed in Belfast	2
i. Active Laughter-Induction Tasks	2
ii. Passive Laughter-Induction Tasks	3
b. Inducing laughter using the sixteen enjoyable emotions induction task	4
4. Database and website construction.	7
a. Ethical issues with databases.	8
b. Issues arising from previous websites	8
i. Previews and download size	8
ii. Scale of the Database	8
iii. Formats and Challenges	9
iv. Search functionality and browsing	10
v. Technical Aspects of the Database	10
vi. Annotation and Questionnaire Mechanism	11
5. Annotation	11
a. The range of Annotation Schemes	11
b. Annotation in Task 1.6:	15
i. Belfast full body motion capture	15
ii. Belfast story-telling sessions.	15
iii. Annotation strategy for Phase 1 of the context experiment.	16
6. IMMELLT (It Makes Me Laugh Like This)	20
7. Conclusions	23
8. Bibliography	24

TABLE OF FIGURES

<i>Figure 1 Hilarious laughter Induction Session – Belfast, March 2012.....</i>	<i>4</i>
<i>Figure 2 Schema displaying the layout of the sensors and data capture equipment used in the Belfast Story-Telling sessions.</i>	<i>7</i>
<i>Figure 3 Laughs Per Minute in Story-telling sessions for each linguistic group and each story-telling emotion.....</i>	<i>13</i>
<i>Figure 4 Mean Laughs Per Minute in Story-telling sessions for each story-telling emotion.....</i>	<i>14</i>
<i>Figure 5 Laughter Annotation Page from Phase 1 of the Context Experiment</i>	<i>18</i>
<i>Figure 6 Laughter Annotation Page from Phase 1 of the Context Experiment</i>	<i>19</i>
<i>Figure 7 Categories of “things that make people laugh”</i>	<i>21</i>
<i>Figure 8 The types of laughter reported as a response to the laugh producing items.....</i>	<i>22</i>
<i>Figure 9 Categories of things that people perceive are funny to others but not to themselves</i>	<i>23</i>

1. Executive Summary

The current document reports on the extent to which we have achieved one of the goals set by Task 1.6 – building and annotating a mono-cultural database of hilarious laughter. As outlined below, we have successfully developed techniques for inducing hilarious laughter and have used these to collect material for the database. The resulting database now houses an extensive collection of hilarious laughter; recorded using motion, audio, respiratory and video capture equipment. We begin by reporting in detail the outcome of our first laughter induction session run in Belfast, with reference to the development of the tailor-made multi-modal recording systems and the techniques that are effective at inducing hilarious laughter.

We will then describe the second laughter induction session, which made use of SSI synchronised recording software developed by Augsburg. This second session is part of a larger experiment initiated in response to the reviewers' request that we investigate the role of context in laughter recognition/synthesis. An early positive consequence of this experiment is the opportunity it afforded to collect laughter from a second linguistic group (Spanish speaking); thus giving the project an early start in addressing cross-cultural issues in laughter phenomena

As well as inducing hilarious laughter, there was inevitably some conversational laughter captured during the above sessions – particularly in session 2, which was a 'story telling' exercise. These data will contribute to the much larger conversational laughter database envisaged by Task 1.7.

The report will then address the issue of annotation. While physical segmentation annotation has been unproblematic, settling on a single annotation scheme for laughter categorisation has proven to be more difficult. In this report we review the annotation schemes for laughter – both pre-existing and those developed within the ILHAIRE project. Substantial annotation has been completed on the physical segmentation of laugh instances, as well as annotation of laugh-related phenomena. We have designed an experiment (currently running) that assesses the utility of a range of annotation schemes and will inform the project about the appropriate and most useful annotation approaches beyond physical segmentation of laughter. In addition we have constructed a website-based procedure which facilitates the gathering of laughter annotations.

Finally, we will give a detailed account of the construction and architecture of the database and website. The website is live and currently available to users on condition that they sign an end user licence agreement, which stipulates the terms and conditions under which the multi-modal data can be used. Already the website has become an important hub of activity within the ILHAIRE project, and we are confident its importance as a research resource will be firmly established within a broader academic base.

2. Introduction.

The first twelve months of the ILHAIRE project had Work Package 1 focusing on and identifying material that induces various types of hilarious laughter (Task 1.1), and assembling resources containing audiovisual records of (mainly conversational) laughter (Task 1.2) (see Deliverable D1.1). In the case of Task 1.1 an online survey (IMMELLT – it makes me laugh like this) generated data on the different types of laughter that people express, and the material that induces such laughter. For Task 1.2 we identified and assembled several resources that are rich in laughter – the Belfast Naturalistic Database (Douglas-Cowie, Campbell, Cowie, & Roach, 2003), the HUMAINE database (Douglas-Cowie et al, 2007), the Green Persuasion database (Douglas-Cowie et al., 2007), the Belfast Induced Natural Emotion database (Sneddon, McRorie, McKeown, & Hanratty, 2012), and the SEMAINE database (McKeown, Valstar, Cowie, Pantic, & Schröder, 2012). The resulting database contained mainly conversational laughter, and contained little hilarious laughter. This report, which concentrates on work conducted in relation to Task 1.6 – collect and annotate synchronized multimodal recordings of hilarious laughter – anticipated this lack of hilarious laughter material. We have developed new techniques for inducing laughter. These techniques were implemented in Belfast (March, 2012) and have resulted in a rich database of hilarious laughter. The annotation is on-going. As well as inducing hilarious laughter, the project was tasked by the expert review panel (Brussels, 1st October 2012) to explore the importance of context in laughter recognition and synthesis. To this end we have designed and are running an experiment aimed at addressing whether and to what extent one can correctly identify types of laughter in the absence of context (Belfast, December 2012). In generating the laughter for this experiment, we took the opportunity to design the laughter-induction sessions such that hilarious laughter would also be produced. The following report provides a detailed description of the above research activities.

3. Laughter Induction Techniques in Task 1.6

a. Laughter-Induction Techniques Developed in Belfast

The laughter-induction techniques developed in Belfast fell into one of two categories – active laughter-induction tasks and passive laughter-induction tasks. Both techniques were designed to facilitate multi-modal recording of laughter, including respiratory measures, body movement measures, high quality audio, and high quality video. As genuine laughter is an elusive social signal to generate on demand, but very common in natural settings, the first lesson we learned in our attempts to generate it was the importance of creating a social setting that is conducive to laughter generation. We sought to break the formality of the laboratory environment by putting on background music and by encouraging those in the laboratory (including the researchers) to join in and chat and generate a generally jovial atmosphere. In motion capture experiments a substantial amount of time is necessarily spent setting up the equipment. The inherent absurdity of fixing visual markers to the participants was highlighted and often became a source of amusement itself.

i. Active Laughter-Induction Tasks

In the active tasks participants were encouraged to move about the motion capture volume freely unless constrained by the requirements of the task. We devised seven active laughter-induction tasks, six of which were designed to induce hilarious laughter and one which was designed to induce non-hilarious (social)

laughter. Of the six hilarious-laughter-inducing tasks, four tasks were successful at inducing hilarious laughter. For the purposes of task 1.6 we will focus here on those four tasks, which comprise two games, role play and tongue twisters

Games. We identified two games that induced hilarious laughter; these were Bopit and the Wii Dancing game. Bopit is a game of skill and speed involving two players. The requirement for speedy responses leads to mistakes being made, which often resulted in participants laughing either at their own errors or their opponents' errors. While Bopit did induce hilarious laughter, it was not as reliable or consistent a task as the Wii Dance game. The Wii Dance game was particularly successful at inducing laughter in participants who were observing another participant dancing – i.e. the observers were 'laughing at' the dancer.

Role Play. The role play involved participants (and researchers) competing in a 'catwalk' competition, in which each person took it in turn to walk along an imaginary catwalk in an exaggerated 'model-walking' manner. Again this task was very successful at inducing hilarious laughter – mainly in the form of observing participants laughing at the 'cat-walking' participants.

Tongue Twisters. This involved participants reading rhythms that are written to induce linguistic errors resulting in taboo words being uttered. This task was successful at inducing hilarious laughter in both the reciter and the observer participants. It did not appear to be simply the taboo nature of the material that created laughter but some interaction between the social grouping, the atmosphere and the task that resulted in laughter.

ii. Passive Laughter-Induction Tasks

In the passive laughter-induction tasks participants watched pre-selected YouTube films or created a YouTube 'journey' by viewing footage they chose themselves. The former task was moderately successful at inducing laughter, and the latter task proved to be very effective in generating laughter. Participants were seated on low level stools with no back supports, thus allowing them to move backwards to the extent they desired while laughing.

We used the Qualysis motion capture system – an optical motion capture system with retro-reflective markers placed on key points on the body – to record participants' movements. The motion capture system utilised 18 cameras over a large volume normally used for gathering sports related motion capture data. Two marker placement schemes were used, one more extensive than the other. An image of this laughter induction session can be seen in Figure 1. In addition to the motion capture system, two high quality video cameras and head-mounted wireless microphones were used to record the sessions. The success of the Belfast laughter-induction session is evidenced by the quantity of data gathered – approximately four hours of laughter-rich motion, video and audio capture. More details of these techniques are described by McKeown et al (2013).



Figure 1 Hilarious laughter Induction Session – Belfast, March 2012

b. Inducing laughter using the sixteen enjoyable emotions induction task and the context experiment

We used the 16 Enjoyable Emotions Induction Task (Hofmann et al, 2012) to generate laughter material for the context experiment. In the enjoyable emotions induction task participants are recruited at least a week ahead of the session. They are informed about the nature of the task and are instructed to prepare or think of stories that relate to each of 16 positive emotions or sensory experiences. We recruited two language groups as participants – Spanish speaking and English speaking. There were 3 groups of 4 participants in the Spanish speaking sessions and 3 groups of 3 participants in the English speaking sessions.

At this stage a brief introduction to the context experiment and its implication for the mono-cultural nature of the database outlined in Task 1.6 is required. The context experiment is designed to examine what happens when laughter is removed from its surrounding linguistic and non-verbal contexts. The goal is to determine if the categorisation of laughter into different types is driven by information communicated by the laugh itself, or if laughter is categorised into different types using information derived from contextual cues that are not intrinsic to the nature of the laugh. As people often laugh while speaking we sought two linguistic groups with the assumption that if people rating laughter could not understand the language this would minimise the linguistic context available for use in the categorisation of laughter. We also sought to minimise non-verbal context through the extraction of the laughs from the surrounding material in a video clip – lasting from approximately one second before to one second after a laugh event. A consequence of this experimental paradigm is the necessity that data gathered in this task comes from two linguistic groups and therefore arguably two cultures. What comprises a mono-cultural database is a difficult question to address as cultural boundaries are increasingly difficult to define, especially in modern Western Europe. However, the task was outlined as mono-cultural as part of an incremental development that would see later additions to the database that would make it a multi-cultural database. The degree to which the participants in the two linguistic groups tested here are from distinct cultures is difficult to define as they are all people who have

been resident in Europe and the United Kingdom for an extended period of time so the degree to which the claim can be made that they are culturally isolated is debateable. Later in the project we aim to capture laughter data from people who have much less exposure to the developed world. The later data combined with the current data should provide a gradient of cultural differences which will allow interesting comparisons to be made. For the context experiment we have data available from each of three language groups from Western Europe – the English and Spanish groups collected in this data gathering session and a similar data gathering session using the 16 Enjoyable Emotions Induction Task in Zurich with participants speaking Swiss-German. The Swiss-German videos cannot unfortunately be made available to the database due to the nature of the agreement between the researchers and the participants of those sessions. However, we hope that the addition of two linguistic groups with identical experimental conditions should provide data that can be utilised by the broader research community to replicate and address similar research questions in the future. Details of the Swiss-German sessions can be found in Deliverable report D1.1.

When the participants arrived to the story telling session they took their places in the seats and were instructed once again as to the nature of the task they were required to do. At this stage they were also required to fill out a series of questionnaires. While the other participants completed their questionnaires, each participant was selected in turn to read out a standard set of linguistic phrases drawn from the TIMIT Acoustic-Phonetic Continuous Speech Corpus (Garofolo et al., 1993; see Table 1). The objective in including these standard phrases is to provide data that allows the study of voice adaptation, an area already well explored in speech and other aspects of auditory communication but not yet in laughter. The addition of these phrases should aid the goal of adding laughter to the list of adaptation in auditory phenomena. These phrases have been made available in the form of audio wav files associated with this session in the ILHAIRE database.

Table 1 TIMIT phrases used for acoustic-phonetic calibration

	TIMIT Phrase
1	She had your dark suit in greasy wash water all year.
2	Don't ask me to carry an oily rag like that.
3	When we left Washington his son Tad was ill and Mrs. Lincoln hysterical.
4	She always jokes about too much garlic in his food.
5	The courier was a dwarf.
6	Like as if it were built of books.
7	The triumphant warrior exhibited naive heroism.
8	According to my interpretation of the problem, two lines must be perpendicular.
9	By eating yogurt, you may live longer.

10	The diagnosis was discouraging; however, he was not overly worried.
----	---

Once the initial phase was completed the story-telling phase began, during which participants were required to take turns at recalling a story associated with an enjoyable emotion. The list of enjoyable emotions was randomised for each story telling session, and all of the participants told stories associated with the same emotion in each round of stories. Hilarious laughter occurred to varying levels depending on which emotion was being recalled and the nature of the story that was being recounted. The story-telling events occasionally evolved into an open discussion, which further facilitated episodes of hilarious laughter. Participants were seated in comfortable chairs around a central table, and each participant wore a head-mounted microphone to capture high quality audio recordings. Kinect motion capture technology was used to capture facial features, gaze direction and depth information; something that was not possible to do in the previous body focused motion capture sessions. The facial motion capture was run concurrently with video and audio recordings. We ran the laughter induction sessions using two language groups as participants – Spanish speaking and English speaking; and added laughter previously recorded with Swiss-German speaking participants. Between 9 and 12 participants from each language group were recruited for the sessions.

A final aspect of these data recording sessions involved getting the participants to imitate a sequence of 10 laughs drawn from the AVlaughterCycle database. At the end of each story-telling session we asked each participant in turn to watch these exemplar laughs at full screen size on a 15” laptop and try to imitate the laughs – these imitated laughs were recorded using the same recording equipment. The goal here was to develop a repository of artificial laughter data that could aid in the study of laughter adaptation in addition to the voice adaptation used .

The data capture aspect of these recordings was extremely intensive. To capture synchronised data we required the use of 9 computers and a network attached storage (NAS) system. Streaming the data from a single participant required a dedicated computer for each HD webcam and Kinect, making a total of 8 computers to capture the data. The HD Webcams streamed video data to the computers at 25fps, with a resolution of 1024x576 for three of the cameras and 960x720 for the fourth camera. These streams were compressed with the Huffiyuv lossless codec and later compressed using the lossy H264 to make more usable file sizes; we have retained the lossless files but plan to make available the smaller format. The audio from each head mounted microphone was fed into a MOTU 8pre FireWire audio interface preamp, and from there into another computer with Firewire 800 recording hard drives. Audio was recorded using wav format files (mono, 48000Hz, 24-bit PCM). The sessions each lasted about 90-120 minutes, with about 75 minutes recording time. As participants were recorded when they were speaking and listening this meant the data requirements were similar for each participant. These sessions generated an enormous amount of data making storage and compression an issue – we used a QNAP TS659 Pro II network attached storage system to store the approximately 3 Terabytes of data generated by these sessions. These have been compressed (as outlined in section 4b(iii)) for delivery in the ILHAIRE database website. Synchronization of these signals was achieved through the use of SSI software. We additionally used standard video recording equipment as a backup recording system;

however as this is not synchronised to the other data streams it remains less useful. Figure 2 displays a schematic diagram of the recording set-up used in these sessions. Greater technical detail of the methods used in data capture and the synchronization methods are provided in Deliverable 1.2.

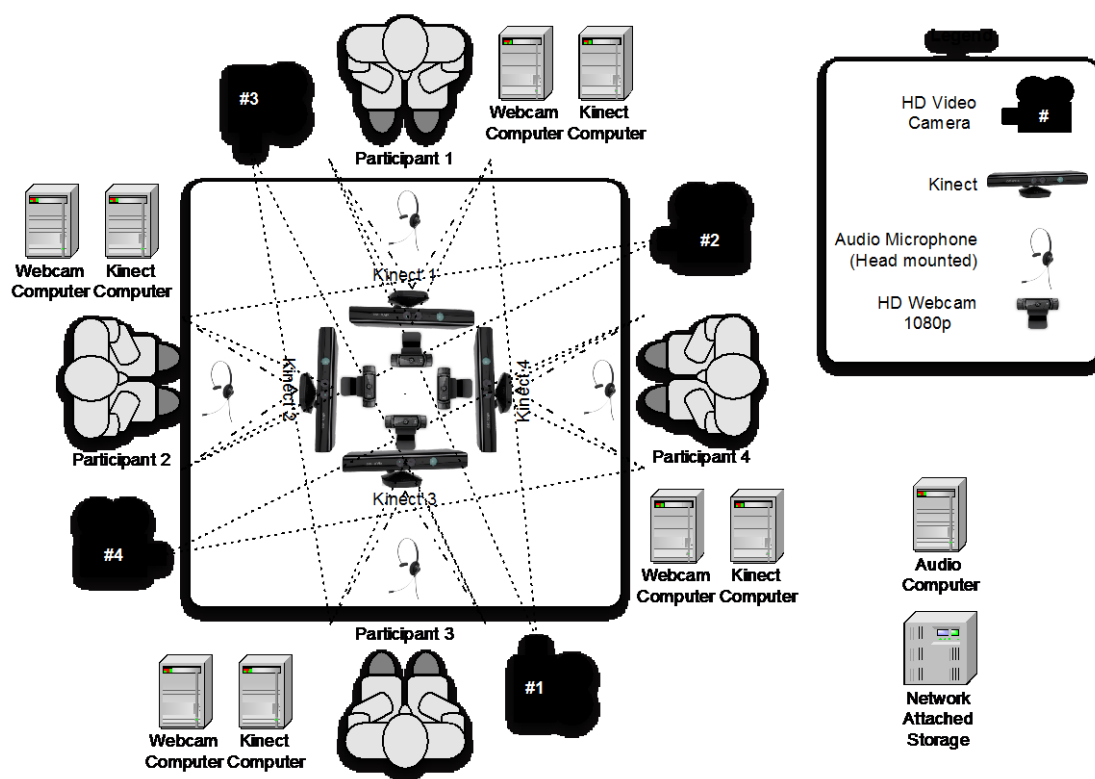


Figure 2 Schema displaying the layout of the sensors and data capture equipment used in the Belfast Story-Telling sessions.

In addition to the enjoyable emotions induction task, we are currently using the same experimental set up to record conversations of dyads, in which the dyad are given random topics to discuss. There are two motivations for this additional laughter capture. The first is to examine evidence that the laughter dynamics in groups of 3 or 4 are qualitatively different to dyad laughter dynamics (Glenn, 2003). Secondly we aim to capture a large amount of material from just a few sources who will be repeatedly assessed in a dyad setting. This need for large amounts of data from single or a few sources is a requirement for the development of more natural audiovisual laughter synthesis. Although they are still at an early stage, the dyad recording sessions promise to be rich in hilarious laughter.

4. Database and website construction.

The website was designed based on experience with other mechanisms for the delivery of other multi-modal databases of emotion. In particular the QUB team have been involved in production and distribution of the Belfast Naturalistic Database, the HUMAINE database, the SEMAINE database, The Green Persuasive Database, and the Belfast Natural Induced Emotion Database. The goal in the website design was to take the best of these features and adapt them for use in the ILHAIRE database.

a. Ethical issues with databases.

Pre-internet delivery of audio-visual databases involved packaging the audio-visual material in CD-ROM and DVD formats and sending them through post or courier to whoever expressed an interest. They were also required to sign an End-User License Agreement (EULA) satisfactory to the nature of the research and any agreements made with the participants. Often in this era there was little attention paid to issues of copyright. The move to internet delivery of database information had a variety of implications for emotional databases. Primarily the change was a positive one; much of the process could be automated, there was no need for physical materials to change hands and access could be controlled at a distance. However, it did raise issues that needed to be addressed. First, copyright issues had to be taken more seriously. A second more serious concern is that the images and videos that participants had provided in good faith were now digitally available and could be replicated and made available on a scale that many participants may not be comfortable with. The solution to these concerns requires strong enforcement of an EULA and a database that clearly defines and delineates what can be done with each audio-visual clip.

b. Issues arising from previous websites

i. Previews and download size

The most basic functionality in a website is the delivery of audio-visual material. Many of the database websites do provide just the material, in the form of large zip archive files. As these materials are video files – often of very high quality – they can be large and cumbersome and take time to download. This puts a lot of the onus on the database user who is required to download an entire database and then make decisions about the usefulness of the various parts of the database to their research goals. This is highly inefficient as, in our experience, providing a simple glance at a few exemplars of the audio-visual material can be very informative to a researcher concerning how the material will fit with their research goals. Often the usefulness of a database can be discerned very quickly and much material can be ruled out quickly if it is not suitable. In this respect we wished to include the ability to preview at least some of the content in the ILHAIRE database before researchers are required to commit to a download of large amounts of material. The SEMAINE database offers this kind of preview option although it is constrained and tightly integrated with the search functionality of the SEMAINE database and less suitable to casual browsing.

ii. Scale of the Database

There is an issue of scale in many databases. Often databases have been designed with a single purpose in mind. The Belfast Naturalistic Database sought to provide a cross section of emotional material from a variety of emotional scenarios. The HUMAINE database sought to provide exemplars from the range of databases that were available at the time of its creation, to inform researchers of the breadth of material. The SEMAINE database was focussed on the specific goals of the SEMAINE project in creating realistic human-avatar conversational interactions (Schroeder et al, 2012). The goals of the ILHAIRE database are less well specified. There is a basic remit that is clear, in that the database concerns laughter and the goals of the ILHAIRE project in general. However, as is noted in Work Package 1 titled

“Incremental Database”, the database is required to contain many different sorts of data and increase in size and scale as the project produces data. There are three main phases to this incremental aspect of the ILHAIRE database. The first phase involves laughs extracted from pre-existing databases (Tasks 1.2 and 1.4). The second phase involves hilarious laughter generated as part of Task 1.6; and the third phase involves the addition of conversational laughs generated as part of Task 1.7. In addition there is a goal that material from different cultures and linguistic groups will increase the value and extent of the database. The incremental nature of the database has required the website to be designed in a modular format that can accommodate these different phases and in a way that can cope with increasing volumes of laughter material. The material comes from a variety of sources – the pre-existing databases and from data collected by the various ILHAIRE project members – and as a result it exists in a variety of formats. Due to this variation there are additional issues requiring the harmonisation of the data across the data types.

iii. Formats and Challenges

There is a strong focus on multimodal data within data gathered for the ILHAIRE database. These data are also gathered with the high levels of quality that are often required for machine learning algorithms. These issues, combined with the variety of sources generating data, make it difficult to create a consistent data style across the various formats. Data are regularly gathered separately in audio formats, video formats, and varying motion capture formats. Included are other less common data gathering techniques such as respiration monitors. There are no formal enforcements of data format but where possible they will adhere to these suggested levels of quality.

Audio: The preferred audio format is the .wav format, the frequency in kbit/s will vary depending on the research goals.

Video: Preferred video compression codec is H.264 at 1024 kbit/s; where this is combined with audio the preferred container is an mp4 container. The data from the Belfast story-telling sessions comes in this format at 25 fps.

Motion Capture: There is no preferred format for motion capture. There are at least four types of motion capture being used throughout the ILHAIRE project: Qualisys, Animazoo, Optitrack, and Kinect based systems are all employed in different aspects of the project. Motion capture and the presentation of motion capture data within the database creates challenges for the presentation of data on the website. Some of these issues will be addressed in Deliverable 1.2.

Short Audio-visual Clips: One issue that arises when extracting laughs from their surrounding verbal and non-verbal contexts is that this can present playback issues depending on the compression codec used. When video clips capture fleeting phenomena – such as a laugh-pulse that can take place in less than a second, or a laugh episode or bout spread over a few seconds – the video clip is necessarily very short. Typically codecs rely on larger sequences to achieve the data compression that they need; for short sequences there can be implications resulting in playback that can be jerky and skip frames. This is clearly an issue where we are concerned with the scientific evaluation of laughter. To deal with this problem, affected laugh clips have been re-encoded using the Apple Prores 422 codec; which results in much larger files but ensures there are no playback issues that may interfere with any

scientific conclusions concerning the laughs. After this they can then be re-encoded again into different formats that will ensure a broader range of playback options. The preferred option is again H.264 in an mp4 container as this can be played on most computers in addition to playback using Adobe Flash player.

iv. Search functionality and browsing

Most databases do not offer search functionality. The SEMAINE database is an exception, as it offers a search based on format features of the videos and participant characteristics. The ILHAIRE database currently offers limited search based on words within the website; that is, a search can take place on the website as a whole – if there is relevant text in the descriptors of a section of the database then it will be highlighted by the search. There is currently no search functionality based on format type or on the characteristics of participants but this functionality may be added as the contents of the final database become more concrete. What the ILHAIRE database offers that most others do not is a hierarchical structure that allows browsing of the database contents. This was chosen due to the incremental and modular nature of the database. The goal is that users can enter the database and explore the various types of data that are offered by the database. Each of the main data gathering sessions that has taken place in the project has its own top level menu and, upon clicking the menu item, the data is then structured according to the format of the data gathering session. Where possible, preview functionality is available for the sessions in the form of audio-visual clips. Preview functionality for motion capture data remains a challenge; the variety of motion capture formats and the relatively small demand for web based motion capture data means that there are limited options to permit this. However, if a relatively straightforward implementation becomes available, it remains a goal that we would add this to the functionality of the website. The browsing structure is based around the data gathering structure and this will remain the case. Whenever the annotation becomes more developed we aim to include functionality that will allow users to search for laughs that fit within a particular laugh annotation type; thus allowing users to generate laugh collections across the various segments of the whole database.

v. Technical Aspects of the Database

The database is constructed using the Joomla (Version 2.5.9) content management system built on a Linux, Apache, MySQL, PHP (LAMP) webserver stack. This open source content management system allows a secure and feature rich platform on which to build the database. It also allows for the incremental addition of material to the database by a number of authors and contains a detailed user management structure. Users are divided into four kinds. Public users have access to the front pages and some additional information about ILHAIRE. Registered users get to browse the site reading information about the various kinds of data that are available through the database, but they cannot see the video previews or access the compressed data archive files. End User License approved users have full access to browse the video previews and download the data archive files. Finally, administrators can add additional content and manage user groups. A planned future update to Joomla version 3 will allow browsing of the database on mobile devices.

The database is made available with URL:

vi. Annotation and Questionnaire Mechanism

Existing outside the main Joomla website, an additional functionality has been developed to provide an annotation and experimental mechanism that can be used across the ILHAIRE consortium. This is primarily built around the open source survey software Limesurvey. This allows for the provision of experiments that can avail of pre-prepared questionnaires and answer scales. The system is currently populated with questions and answers for English, German and Spanish versions of the following scales: Big Five Inventory; the State Trait Cheerfulness Inventory; The GELOPH 15; and The Interpersonal Interactivity Scale. French versions will also be added. In addition, there are English version of the Ten-Item Personality Inventory and a number of demographic questions. Finally, personality and mood scale annotation and experimental items can be created that include videos of laughter of certain scenarios; this is achieved using the videojs javascript video player embedded within the questions.

5. Annotation

a. The range of Annotation Schemes

We have already completed a substantial amount of physical segmentation, which contains important information concerning the sequential dynamics of laughter. These annotations will answer important questions concerning behaviours leading up to and following laughter, and the sequential parameters of laughter

The development of a consistent and coherent annotation scheme for the categorisation of laughter has proved to be a more difficult task than the physical segmentation scheme, outlined above. There are a number of annotation possibilities, some already in existence and some that have been devised as a result of work within the ILHAIRE project. We will now briefly review these annotation schemes.

The project started with an initial broad categorization of laughter into two types of laughter: hilarious and conversational. This has served as a working definition and marks the main distinguishing difference between the goals of Task 1.6 (hilarious) and Task 1.7 (conversational). This scheme was extended as part of a project conducted by the UCL team and also used by the QUB team to a laughter categorization scheme that included the laugh types: Hilarious, Social, Awkward, Fake and Not a Laugh. Later experimentation using this scheme also included a measure of intensity of laughter. Data related to this categorization scheme is available in the document describing Milestone 3 of the ILHAIRE project.

Ruch & Ekman (2001) provide a basic annotation scheme based on the physical features of laughter. This offers a segmentation scheme for laughter components that are separated into laughter episodes, laughter bouts, laugh cycles, and laugh-pulses. A laugh episode contains two or more laugh bouts separated by inspirations. A laugh bout refers “to the whole behavioral-acoustic event, including the respiratory, vocal, and facial and skeletomuscular elements.”

Laugh cycles are the laughter vocalization period and are made up of laugh-pulses, a vocalization starting with an aspirated “h” sound followed by a vowel. A laugh cycle includes a number of repetitive laugh pulses interspersed with pauses.

In conjunction with these pre-existing annotation schemes further annotation schemes have been proposed by QUB and by UZH. QUB started with an exhaustive categorization of laughs and had participants use this extensive list of possible laugh types to categorize laughs. In this exercise the important feature was that the laughs being categorized were drawn from the Belfast Naturalistic Database and the HUMAINE database. These two databases were the result of earlier attempts to provide a cross section of representational emotional experiences; so their use here is assumed to create a representative sample of laughter types that occur in everyday emotional interactions. The details of how this annotation scheme was derived were presented in Deliverable 1.1. The annotation scheme suggested that participants viewing laughter could consistently recognise the following laugh types: Surprised, Anxious, Backchannel, Giggling, Happy, Hilarious, Embarrassed, Sad, Polite, Relieved. A factor analysis of this data also suggested that a dimensional rating might be appropriate for laughter. The dimensions that became relevant in this analysis were:

- **Appraisal of threat:** correlates positively with anxiety, tension and embarrassment, and negatively with simple happiness
- **Controlled communicative use:** correlates positively with backchanelling and contrived or polite laughter.
- **Lack of restraint:** correlates positively with hysterical, helpless or hilarious laughter
- **Malice:** correlates with taunting and schadenfreude.

Two further annotation schemes have been suggested by work completed at UZH, as outlined in Deliverable 1.1. Three experiments asked questions concerning the positive emotional states that might lead to increased likelihood of laughter generation. These experiments suggest that the most likely emotional states to result in the generation of laughter would be amusement, excitement, relief, wonder, ecstasy, fiero and schadenfreude.

Deriving from theoretical discussion, a second simplified annotation scheme was suggested by UZH. This involved 2 dimensions: the intensity of laughter and up-regulation / down-regulation of laughter. The first of these is a standard dimension in emotion research and is easily justified within an annotation scheme. The second is more laughter specific and has something of an overlap with the dimension 'controlled communicative use' suggested by QUB. Down-regulation occurs when a social situation demands that a laugh be muted or suppressed; up-regulation occurs when someone laughs more than is genuinely felt, again most likely as a result of social reasons.

As a part of Task 1.6 we used the 16 Enjoyable Emotions Induction Task (16-EIT; Hofmann, Stoffel, Weber & Platt, 2012) to induce laughter. The procedure used is outlined in more detail in Section 3b. We gathered data from two linguistic groups; Spanish speakers (12 participants in 3 conversational groups of 4) and English speakers (9 participants in 3 conversational groups of 3). In addition to these data, UZH provided recordings of Swiss-German participants (11 participants in 3 conversational groups – 2x4, 1x3). Thus we had a total of 32 participants across which we could assess the prevalence of laughter for each of the emotional states.

This led to a recalibration of the overall number of emotional states in which laughter was likely to be generated. Figure 3 shows the laughs per minute occurring for each of the linguistic groups in each emotional story telling type and Figure 4 shows the combined mean laughs per minute for the all three linguistic groups. Once again there were clear peaks for amusement and schadenfreude, but the results for the other emotions were more equivocal. In adopting an annotation scheme based on these experiments it was, therefore, agreed that it was safer to eliminate those emotions that most clearly did not result in laughter, while at the same time be conservative and inclusive in the middle range of emotional states. This resulted in the elimination of three positive emotions – Gratitude, Naches and Elevation – as candidates for inclusion in the annotation scheme. An agreement has been reached to use an emotional state annotation scheme that includes: Tactile, Olfactory, Auditory, Visual, Gustatory, Amusement, Contentment, Excitement, Relief, Wonder, Ecstasy, Fiero, Naches, Elevation, Gratitude, Fiero, and Schadenfreude.

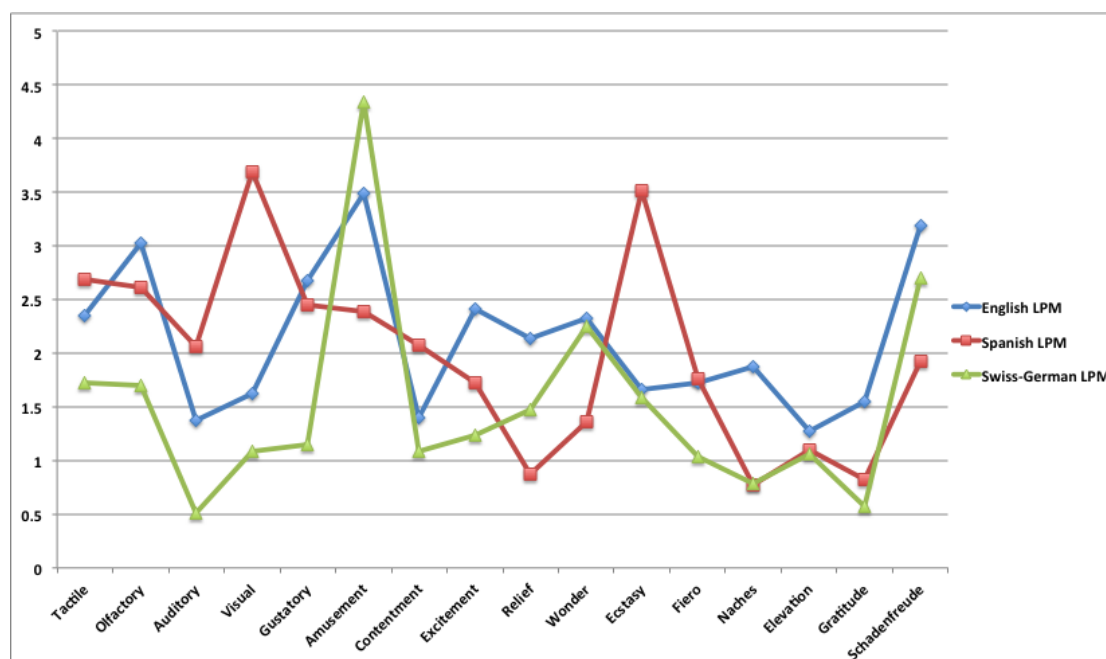


Figure 3 Laughs Per Minute in Story-telling sessions for each linguistic group and each story-telling emotion

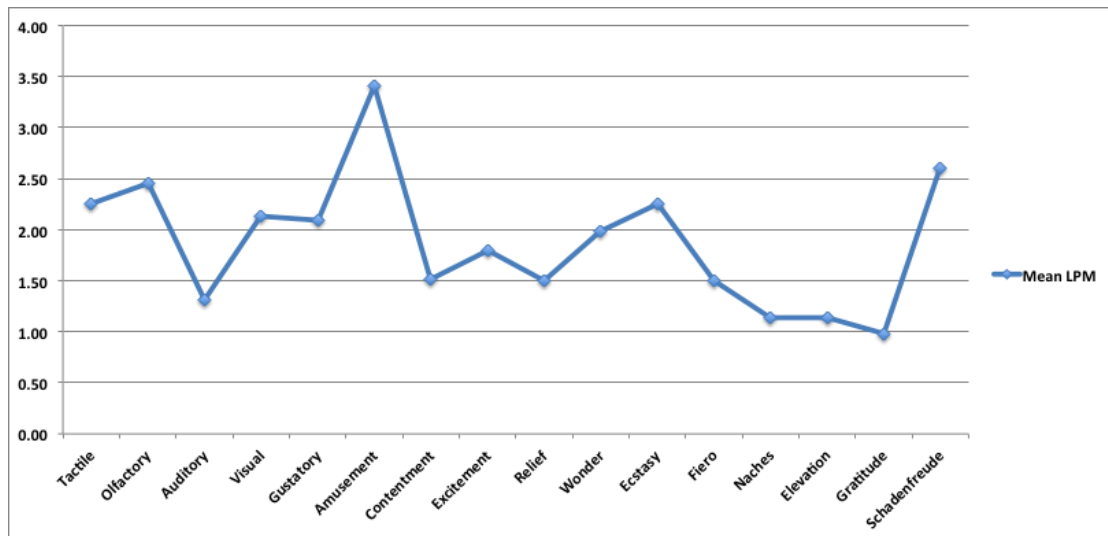


Figure 4 Mean Laughs Per Minute in Story-telling sessions for each story-telling emotion

In addition to these available annotation schemes, and as a result of the first year review highlighting the importance of paying attention to pragmatics and linguistic structure in relation to context, a more detailed look at a well established laughter annotation scheme was conducted. The relevant request from reviewers is detailed:

“The importance of context in laughter recognition and interpretation (as well as in synthesis) should be considered more frontally and operationally. This involves in particular a need to encode explicitly context in the annotated databases which are built (context should range from personality traits and mood of individuals to the pragmatics and semantic meanings of interactions). A thorough study of context should also be conducted very early in the design of experiments.”

There is a long history of annotating laughter in interactions in the field of sociolinguistics and particularly within the area of conversation analytics. The intention was to include annotation of this nature in the laughter collected in Task 1.7; but given the requests by the reviewers, and the fact that the Belfast story-telling sessions contain many instances of laughter (both hilarious and conversational) it is worthwhile presenting a preliminary assessment of laughter annotation from conversation analysis. This field has a long history, with origins in the work of Erving Goffman, and has been strongly influenced by the work of Sacks, Jefferson and Schegloff (e.g. Sacks, Schegloff, & Jefferson, 1974). This annotation revolves around a detailed transcription of a conversation or, in the current instance, story telling. However, in contrast to normal transcriptions, these attempt not to translate stated conversations into written prose but to capture the nuances and many non-verbal aspects of the conversational speech. In particular there is a method for annotating laughter, and the system is clearly outlined by Glenn (2003). It involves annotating words with explosive aspirated *h* sounds as components where there is a laugh particle – a similar idea to the laugh pulse of Ruch & Ekman (2001). An example from Sacks, Schegloff and Jefferson (1974) is:

M: I'd a'cracked up 'f duh friggin (gla- i(h)f y' kno(h)w it) sm(h)a(h) heh heh

The laughs outside of speech in this instance are annotated using the “heh heh” phrasing, the laugh particles within speech are annotated by the (h) within the

written words. Other laugh relevant annotation from Glenn (2003) include: *Eyes* speech within pound signs to indicate speech said with a smile voice; ·hhh a dot before indicating an inbreath audible aspiration. This is clearly a detailed and laborious annotation strategy but many interesting phenomenon have been documented using the this notation including the importance of laughter in turn-taking and marking transition relevance points in interactions, as well as the sequential dynamics of laughter and the importance of who laughs first in an interaction. This style of annotation concentrates strongly on the sequential dynamics of social interactions that contain laughter. There are many relevant features from this work that may be usefully considered in a laugh annotation scheme. An important concept is the idea of a 'laughable' – this is the normally clear referent of a laugh; which may be something humorous said or acted in a conversation or story, or it may be a figurative expressions (Holt, 2010). Other features that may form a useful part of an annotation scheme are: the first laugh, an important feature that invites others into shared laughter; (possible) second laugh, which often signifies acceptance of the invitation; whether the laugher holds the floor of a conversation (current or other); the context of group number, sequential dynamics differ if there are only two participants from larger group situations; and whether a laugh is affiliative (laughing with) or disaffiliative (laughing at).

While the annotation involving physical segmentation of laughter instances has been straight forward, this range of possible annotation strategies and features that can be brought to bear on laughter categorisation is more problematic. The utility of annotating laughter into categories is currently being investigated in the context experiment, as are a number of other schemes. At completion of the context experiment we will be in a position to assess which of the annotation schemes are appropriate.

b. Annotation in Task 1.6:

i. Belfast full body motion capture

The Belfast full body motion capture data has been segmented based on the audio-visual data and using a segmentation strategy described by Ruch and Ekman (2001). Laughs were segmented into laugh episodes and laugh bouts but not laugh cycles or laugh pulses – the short duration of these laugh events increases enormously the labour required to annotate these features and, as they often happen on a millisecond scale, the ability of humans to accurately annotate these features is questionable.

ii. Belfast story-telling sessions.

There has been extensive segmentation annotation for the Belfast story-telling sessions. This involved segmentation by session and, within those sessions, a segmentation of the laughs that occurred. The story telling sessions were segmented based on who had the 'floor'; that is who was deemed to be the recognised speaker at a given moment in the conversation flow. The nature of the task had a reasonably strong formal turn-taking component making this segmentation reasonably straightforward. On occasion conversational discussions would occur, often at the end of a story; the annotation separates these segments from clear speaker/story-

telling segments. Some occasions led to very short discussions or interjections from other participants but the speaker clearly retained the floor; these shorter exchanges were not segmented, but annotations were made of the instances in which they occurred. Details of the segmentation points have been recorded using the clip frame – as the videos are recorded at 25fps this gives an annotation segmentation precision of 40ms. Laugh segmentation that occurred within the story-telling sessions were based around a goal of capturing laugh episodes or laugh bouts as defined by Ruch & Ekman (2001). These have so far been segmented and extracted for the speaker sessions but not for the listener sessions. Annotation of both speaker and listener sessions will be crucial in understanding the sequential dynamics of laughter in interactions and is planned. The annotation has generated a total of 255 laugh instances from the Spanish speaking sessions and 391 laugh instances from the English speaking sessions – where speaking session means that the speaker was the focus of the video. Segmentation and annotation for the listener sessions remains to be done.

In addition to this annotation there is contextual annotation in a variety of formats. Emotional context can be derived from the nature of the emotion that the story is supposed to be conveying. Group context differs in the number of participants that are involved in each session. Furthermore we have acquired personality information for each of the participants providing measures of mood. We have, therefore, added a variety of annotations where we thought they were useful. The nature of the task meant that many of the laughs appeared to represent turn relevance places where, in terms of Conversation Analysis, the laugh is offered as an invitation to other participants to take over the conversation. Instances of stories that end with such a laugh have been annotated. Also there has been some annotation of instances of stories that contain a strong smile voice component that does not develop into laughter.

iii. Annotation strategy for Phase 1 of the context experiment.

In the first phase of the context experiment we have sought to examine a number of annotation styles to find out which are the most appropriate for the annotation of laughter in the absence of context. The segmentation previously outlined was used in terms of the context experiment to extract the laughter from the linguistic and non-verbal contexts of the speakers in the story-telling sessions. Clean segmentation is not always possible due to laughter often being interspersed with speech. We exhaustively segmented the laughs from the speaker sessions with the goal of providing a complete annotation to allow an analysis of the frequencies with which each type of laughter appears in this task.

We selected a range of potential annotation styles and developed five separate questionnaires with which to assess the laughs. For each laugh we have asked participants to rate them on a number of our previously mentioned annotation schemes.

1. As the laughter was generated in the process of the 16 enjoyable emotion induction task we have asked participants to tell us what emotion they feel is most closely associated with the laugh in the video clip. We have used the options of thirteen emotions outlined previously in this section of the annotation combining the work of UZH and QUB.
2. We also asked participants to provide confidence ratings related to the choice of emotion to allow us to judge level of certainty associated with a classification.

3. In addition to this we asked participants to provide a rating of the level of intensity (on a ten point scale) they would associate with a laugh following the dimensional rating scheme of UZH.
4. Two questions related to two of the dimensions suggested by QUB and related to the Gelotophobia research of Work Package 5. These ask the participants to rate the level of maliciousness and level of benevolence associated with the laugh in question (on a ten point scale).
5. We also ask participants to rate how humorous they found the laugh and how conversational they found the laugh (on a ten point scale). This is based on the fundamental distinction made in the ILHAIRE description and that distinguishes Task 1.6 from Task 1.7.
6. Finally, we also ask participants to rate how genuine or fake a laugh seems to be (on a ten point scale).

Figure 5 and Figure 6 show the laughter annotation page as it is seen by a participant rating the laugh types. This is using the Annotation mechanism outlined in Section 4b (vi).

* Which feeling or emotion would you most closely associate with the laugh you observed in the video clip?



Choose one of the following answers

- ☐ Tactile
- ☐ Wonder
- ☐ Amusement
- ☐ Relief
- ☐ Contentment
- ☐ Visual
- ☐ Olfactory
- ☐ Ecstasy
- ☐ Fiero
- ☐ Excitement
- ☐ Auditory
- ☐ Gustatory
- ☐ Schadenfreude
- ☐ Other:

Here are the definitions of the emotions or feelings that may be associated with the laugh.

Auditory - Something that sounds good - *Example - Listening to the sound of the ocean, wind blowing through leaves on a tree or hearing the voice of a beautiful singer*

Olfactory - Something that smells good - *Example - The smell of fresh cut grass or the smell of a baby*

Visual - Something that looks good - *Example - look at a sunset or looking at a work of art*

Tactile - Something that feels good - *Example - Touching something soft like fur, being tickled or having your hair or skin stroked*

Figure 5 Laughter Annotation Page from Phase 1 of the Context Experiment

* How confident would you be in this choice. Answer on the scale from 1 not confident to 10 very confident

	1	2	3	4	5	6	7	8	9	10
Confidence Level	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

* Can you rate the intensity of the laugh on a 10 point scale. From 1 no intensity to 10 maximum intensity?

	1	2	3	4	5	6	7	8	9	10
Intensity	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

* How malicious do you think the laugh was? On a scale of 1 to 10. 1 means not malicious at all and 10 means being extremely malicious.

	1	2	3	4	5	6	7	8	9	10
Was the laugh malicious?	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

* How benevolent do you think the laugh was? On a scale of 1 to 10. 1 being not benevolent at all and 10 being extremely benevolent.

	1	2	3	4	5	6	7	8	9	10
How benevolent do you think the laugh was?	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

* Do you think the laugh was more related to something humorous or more the kind of laugh that would occur in normal conversation? Can you indicate how much by marking along the 10 point scale 1 means not related to humorous/ conversational and 10 means completely related to humorous/ conversational. Place mark in both scales please.

	1	2	3	4	5	6	7	8	9	10
Humorous	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Conversational	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

* Did this laugh feel genuine or fake? Could you indicate to which end of the 10 point scale you think it was with the middle representing neither genuine or fake.

	Genuine									Fake
How genuine did this laugh seem?	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Figure 6 Laughter Annotation Page from Phase 1 of the Context Experiment

In addressing the context issue asked for in the Year 1 review we have, at all data gathering stages, sought to assess the context of the individuals concerned by using measures to assess the “personality traits and mood of individuals.” Before each of the story-telling sessions we asked each of the participants to fill in measures that assess their personality and state. These questionnaires were slightly different for Spanish and English participants. The English and Spanish participants received the Big Five Inventory, a measure of the 5 factor personality structure; The GELOPH 15, a measure of Gelotophobia; and The Interpersonal Interactivity Scale, a measure of empathy. There was a difference in version of the State Trait Cheerfulness Inventory (STCI), a measure of mood and personality traits related to seriousness, cheerfulness and bad mood; the English participants received the STCI-60 and the Spanish received the STCI-104. These are also given to the participants recruited for the laugh evaluation exercise of the context experiment, allowing us to account for personality and mood in both generation and evaluation of laughter.

The context experiment and this annotation gathering session are currently in process and the results will be added to the database and associated with the corresponding files when they become available.

6. IMMELLT (It Makes Me Laugh Like This)

The IMMELLT questionnaire was detailed in Deliverable 1.1 and we continued gathering data in this questionnaire since this deliverable. The questionnaire was based on a premise that laughter would occur reliably given the correct stimulus. However, work in the recording sessions and in the development of the laughter induction techniques has led us to the conclusion that a simple stimulus response approach may work for some people—if they have an alignment of their sense of humour with the stimulus—but that the range of these possible alignments is too great to satisfactorily rely on a stimulus response approach to inducing laughter in laboratory sessions. Much more reliable techniques manipulate the social interactions, settings, and environment in which the participants are required to laugh as outlined in Section 3. Even though we did not adopt the stimulus-response approach in the generation of laughter there is interesting information to be learned from the range of material that people provided in response to the IMMELLT questionnaire.

The IMMELLT questionnaire contained 6 data-gathering sections; these are: demographic information; personality assessment; identifying laughter-inducing material and laughter types; identifying personal humour preferences; the STCI-60; and GELOPH 15 measures.

In total 125 participants answered the IMMELLT questionnaire (99 female and 26 male) and fully completed the questionnaire. Age of participants ranged from 18-49 with a median of 19. As in the case of the pilot data exercise, when asked what type of things made them laugh most participants left a URL of an Internet (mostly YouTube videos: 80 out of 125). The style of material was categorized into twelve categories, and these are displayed in Figure 7. Video clips of funny animals, sitcom/comedy shows were the most popular. Internet humour is a more diverse category of humorous video submissions and internet memes. Other people's misfortunes were also popular with 12 people highlighting pranks style videos, and another 9 selecting people falling over. Videos of people in awkward situations were also included, as were internet videos of comedians (10). Two larger categories did not involve internet videos; these were Friends and Family and Wit, Humour and Jokes. In these categories people either wrote a sentence concerning how family and friends made them laugh or left an instance of a joke.

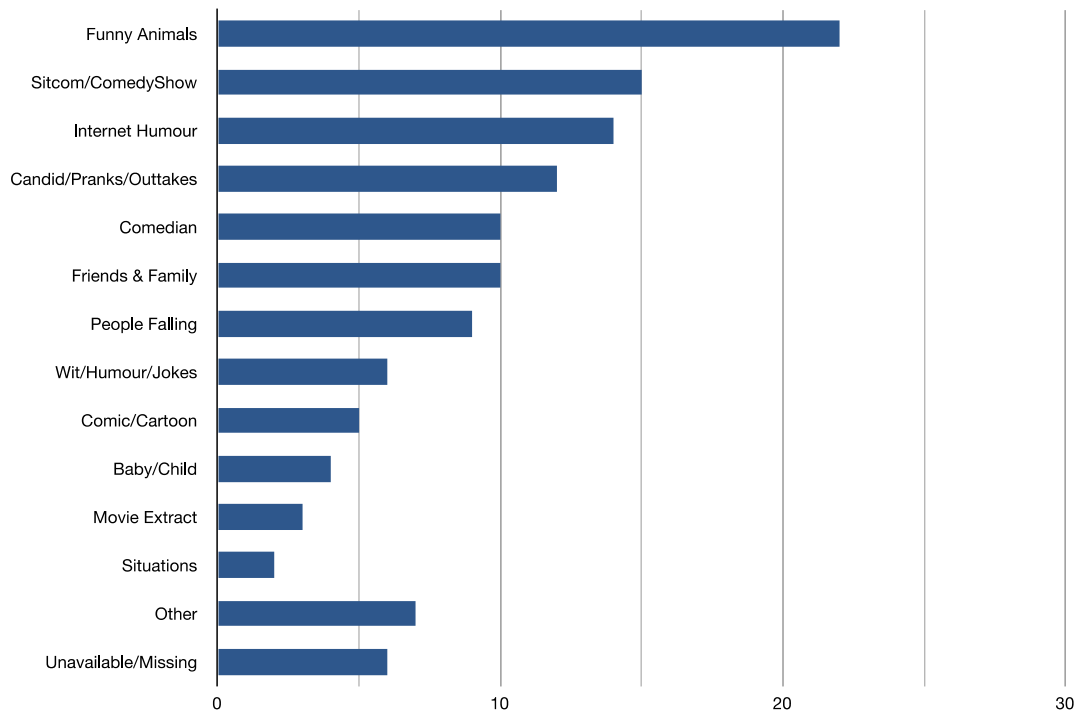


Figure 7 Categories of “things that make people laugh”

As part of the IMMELLT questionnaire we asked for the kinds of laughter induced by these materials. For this we used a categorization of 31 types of laughter together with an “Other” option. Details of this can be found in Deliverable 1.1. Participants responded using a five point Likert scale with the options: never this way, occasionally this way, sometimes this way, often this way, always this way. For the purposes of description these were given the scores 0,1,2,3,4, respectively, and summed to create a measure of the way in which individuals thought the reported items made them laugh. Figure 8 shows the data for the different laughter types generated by these materials. Notably all the peaks come from a group of laugh types that could easily be labelled hilarious laughter—these are happy, hilarious, giggling and hysterical. Also notable are the surprised and meaningful categories and an additional three types which may be related – schadenfreude, mischievous and sarcastic. The other kinds of laugh showed levels of response that make it difficult to distinguish any pattern. A further question sought to see if people thought they laughed more “at” or “with” the focus of the laughter, 62 answered “laughing at” and 59 answered “laughing with”.

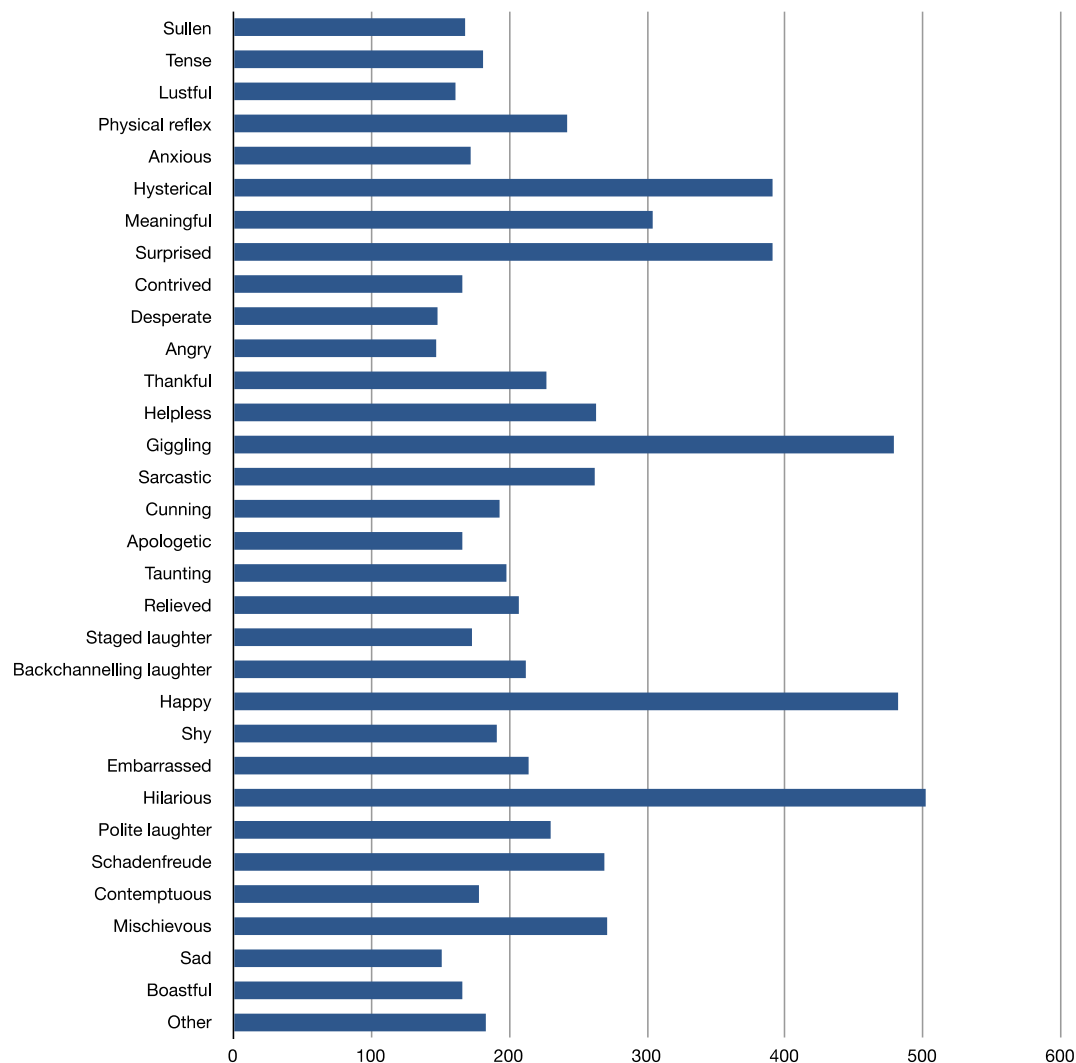


Figure 8 The types of laughter reported as a response to the laugh producing items

Participants were also asked to say what they did not find funny that other people seemed to find funny. This was an open-ended question and respondents often gave more than one reply. These were categorized as exclusion (e.g. “jokes which fuel stereotypes,” “sexist jokes,” “racist jokes”); others’ misfortune (e.g. “people or animals getting hurt”); TV/Movie (certain sitcoms or movies); taboo (e.g. “things that are unnecessarily crude”); Comedian (the name of a certain comedian); Slapstick; Jokes; and other. Figure 9 displays the frequencies with which these reasons were given. Interestingly, while a number of items identified as being funny to others were indeed reported by other respondents to be funny (e.g. people falling), some identified items were not reported as funny by other respondents (e.g. exclusion and taboo items). In particular other people’s misfortune – which would include “people falling over” and “candid/pranks and outtakes” from Figure 7 – was a popular category identified by both sets of respondents. We have personality data for each of these participants and plan to conduct a more in depth analysis of the ways in which personality interacts with these factors.

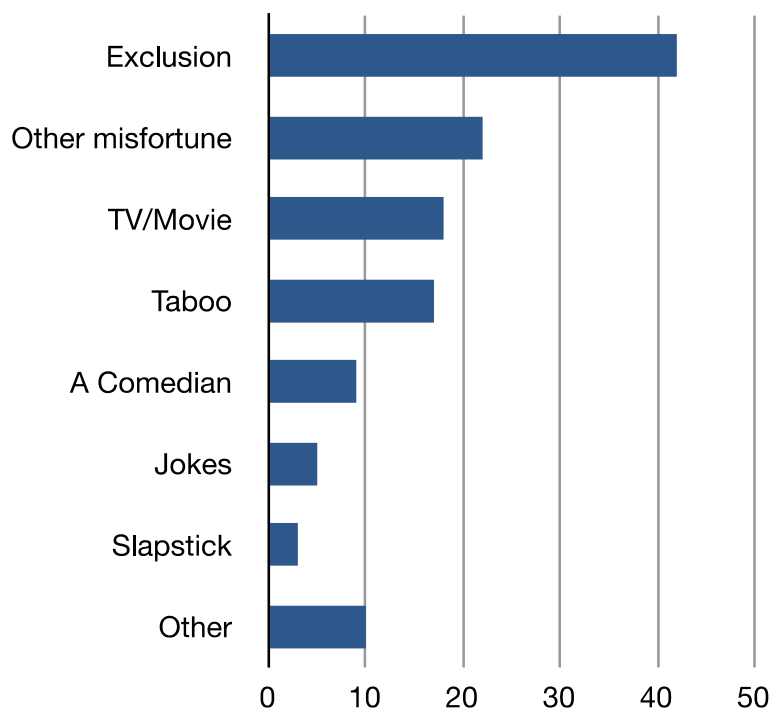


Figure 9 Categories of things that people perceive are funny to others but not to themselves

7. Conclusions

The goals set by Task 1.6 – collecting and annotating synchronized multimodal recordings of hilarious laughter – have been largely realised. We have developed robust techniques for inducing hilarious laughter, and these techniques were implemented in a data gathering session in March 2012. In addition to this we have used a story-telling paradigm, devised by UZH, to induce hilarious laughter for a data gathering session in December 2012. Both data gathering sessions employed state of the art motion, audio and video capture technology; and have resulted in an extensive database of laughter (both hilarious and conversational). We are currently running sessions to capture laughter behaviour of conversing dyads, with the expectation that rules governing the occurrence of laughter will differ from those of larger group laughter. Data from these sessions have been annotated (for segmentation of physical laugh instances, and relevant other phenomena) and are now available on the ILHAIRE website. In addition to the laughter data generated, the IMMELLT project is now near completion; data generated by the IMMELLT exercise was intended to guide the development of laughter-inducing techniques. While the IMMELLT data proved to be of limited use in informing the laughter-inducing sessions, it will be a valuable resource for identifying factors that influence one's propensity to laugh; such as personality type, age group, cheerfulness measures, and gelotophobia measures. Annotation of the laughter database is necessarily on-going. We have already completed a substantial amount of physical segmentation, which contains important information concerning the sequential dynamics of laughter. The utility of annotating laughter into categories is currently being investigated in the context experiment, as are a number of other schemes. At

completion of the context experiment we will be in a position to assess which of the annotation schemes are appropriate.

8. **Bibliography**

- Douglas-Cowie, E., Campbell, N., Cowie, R., & Roach, P. (2003). Emotional speech: Towards a new generation of databases. *Speech Communication*, 40(1-2), 33–60.
- Douglas-Cowie, E., Cowie, R., Sneddon, I., Cox, C., Lowry, O., McRorie, M., Martin, J., & Devillers, L., Abrilian, S., & Batliner, A. (2007). The HUMAINE database: Addressing the collection and annotation of naturalistic and induced emotional data. *Lecture Notes In Computer Science* 4738 pp. 488-500.
- Garofolo, J. S., Lamel, L. F., Fisher, W. M., Fiscus, J. G., Pallett, D. S., Dahlgren, N., & Zue, V. (1993). TIMIT acoustic-phonetic continuous speech corpus linguistic data consortium. *Philadelphia, PA*, 1.
- Glenn, P. (2003). *Laughter in interaction* (Vol. 18). Cambridge University Press.
- Hofmann, J., Stoffel, F., Weber, A. & Platt, T. (2011). *The 16 enjoyable emotions induction task (16-EEIT)*. Unpublished Research instrument, Department of Psychology, University of Zurich, Switzerland.
- Holt, E. (2011). On the nature of “laughables”: laughter as a response to overdone figurative phrases. *Pragmatics*, 21(3), 393–410.
- McKeown, G., Valstar, M. F., Cowie, R., Pantic, M., & Schröder, M. (2012). The SEMAINE Database: Annotated Multimodal Records of Emotionally Colored Conversations between a Person and a Limited Agent. *IEEE Transactions on Affective Computing*, 3(1), 5–17. doi:10.1109/T-AFFC.2011.20
- McKeown, G., Curran, W., McLoughlin, C., Griffin, H. J., & Bianchi-Berthouze, N. (in press) Laughter Induction Techniques Suitable for Generating Motion Capture Data of Laughter Associated Body Movements. *IEEE Face and Gesture* 2013.
- Sacks, H., Schegloff, E. A., & Jefferson, G. (1974). A Simplest Systematics for the Organization of Turn-Taking for Conversation. *Language*, 50(4), 696–735.
- Ruch, W., & Ekman, P. (2001). The expressive pattern of laughter. In A.W. Kaszniak (Ed.), *Emotion, qualia, and consciousness* (pp. 426-443). Tokyo, Japan: Word Scientific Publisher.
- Schröder, M., Bevacqua, E., Cowie, R., Eyben, F., Gunes, H., Heylen, D., Maat, ter, M., et al. (2012). Building Autonomous Sensitive Artificial Listeners. *IEEE Transactions on Affective Computing*, 3(2), 165–183.
- Sneddon, I., McRorie, M., McKeown, G., & Hanratty, J. (2012). The Belfast Induced Natural Emotion Database. *IEEE Transactions on Affective Computing*, 3(1), 32-41. doi:10.1109/T-AFFC.2011.26