Tagging and Linking Lecture Audio Recordings: Goals and Practice

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Abstract: Making and distributing audio recordings of lectures is cheap and technically straightforward, and these recordings represent an underexploited teaching resource. We explore the reasons why such recordings are not more used; we believe the barriers inhibiting such use should be easily overcome. Students can listen to a lecture they missed, or re-listen to a lecture at revision time, but their interaction is limited by the affordances of the replaying technology. Listening to lecture audio is generally solitary, linear, and disjoint from other available media.

In this paper, we describe a tool we are developing at the University of Glasgow, which enriches students' interactions with lecture audio. We describe our experiments with this tool in session 2012–13. Fewer students used the tool than we expected would naturally do so, and we discuss some possible explanations for this.

1. Introduction

Making audio recordings of lectures is cheap (in money and time), and technically straightforward. Together, these mean that it is easy for lecturing staff to create this additional resource without much in the way of support, which in turn makes it easy for them to do so routinely and robustly, with little intellectual or technical buy-in. It is also reasonably easy to distribute the audio to students, and people have in the past done so using VLEs or services such as Apple's iTunes.

It is hard to escape the feeling, however, that while it is easy to *make* recordings, they are hard to exploit fully: there is more value in lecture recordings than is readily accessible. Students can listen to a lecture they missed, or re-listen to a lecture at revision time, but their interaction is limited by the affordances of the replaying technology. Listening to lecture audio is generally solitary, linear, and disjoint from other available media.

In this paper, we describe a tool we are developing at the University of Glasgow, which enriches students' interactions with lecture audio. We describe our experiments with this tool in session 2012–13.

Our general ambitions are:

- to elicit (and share) student generated content in the form of tags attached to audio instants, and links between the audio and other lecturer- or student-generated material;
- to enable and encourage students to interact with the available material, which helps them reprocess it intellectually through, amongst other things, a type of prompt rehearsal;
- to support that reprocessing with pedagogically well-founded exercises and activities; and
- to enable (`empower') students to interact with institutionally provided materials, on multiple devices (including mobile), in an attractive and up-to-the-minute style.

In practice, the `audiotag' tool:

- organises and distributes related recordings into `podcasts';
- supports ‘tagging’ of instants within the audio, in a manner similar to well-known social websites such as Delicious or Flickr;
- supports ‘likes’ of tags, therefore supporting student voting on successful or insightful tagging actions; and
- is designed to be coupled to other tools (we are wrestling with the pedagogic and user-interface challenges of live tagging via mobile devices, in lectures), so that we can support an `ecology' of applications which link to, and are linked from, the tagged audio instants.

There is a video demo of a recent (but not completely up-to-date) version of audiotag at <http://vimeo.com/50070137>.

During session 2012–13, the Audiotag team received funding from Glasgow University (i) to formally evaluate the audiotag service in the context of lecture courses across the university, (ii) to evolve it towards greater usability, (iii) to develop teaching techniques to help students exploit the service possibilities, and (iv) to work with a student developer revisiting the interface and imaginatively exploiting the available service ecology, with cross-links to other media.

To our surprise, we report below a suprisingly low engagement with the audio lectures, on the part of the students we have worked with, which has frustrated our attempts to devise more interesting pedagogical exercises. We discuss some possible explanations for this.

In section 2 we describe some of the motivating background for our current work. In section 3 we describe the software system we have developed to support this work, and in section 4 the results of using this tool to support a set of six lecture courses in astronomy. Finally, in section 5 we reflect on the results we have obtained.

2. Background and motivation

It is still relatively uncommon for lecturers to make available recordings of their lectures. The latest Digital Natives survey (Gardiner 2011) shows that 90% of students expect lecture recordings, so there is at least some, possibly somewhat unfocused, demand for them. Basic audio-recordings of lectures are easy to produce and distribute (creating a podcast is both cost- and time-efficient) so that there are few real technical or cost barriers to making recordings

available. Though there is often some scepticism about the practice, in our experience relatively few lecturers are too shy to have their words recorded, or raise for example intellectual property concerns. Why, then, is lecture recording not ubiquitous?

We can find some explanation by looking more closely at the supply of recordings, the demand for them, and the pedagogical justification for and use of them. We believe that the supply barriers are deemed significant because the demand is too low, the demand is low (or at least too vague) because the student body is unfamiliar with the possibility and so does not know to ask for a supply, and the pedagogical benefits (which might cause lecturers to create the supply irrespective of demand) are underexplored because too few lecturers use the technique for them to successfully explore the space of possibilities.

Supply: Digital voice recorders are now inexpensive (ranging from £30–£150), most people seem to have reasonably ready access to basic audio-editing software, and they can distribute audio files by uploading them to the university Moodle servers. Several of the current group used the free application 'Audacity' to make minimal edits[1], which took perhaps 15 minutes of effort after a lecture; we do not expect lecturers (or support staff) to do any elaborate post-production beyond, perhaps, top-and-tailing, and de-noising, and in particular we do not expect anyone to produce anything more sophisticated than a reasonably audible hour of one individual's monologue. The final step of making a podcast from the audio collection[2] is more intricate, but Moodle, like many similar services, has a podcasting plugin. Each of these technical obstacles is by itself relatively minor, but in combination they are a barrier substantial enough that only an enthusiast would currently breast them.

There is also a type of 'supply' question from the students' side, in the supply of technical expertise which students can already be assumed to possess. Students (or the younger ones at least) have been described as 'digital natives', more than 98% of whom have ready access to a computer, 65% of whom share photos on social networks, and 20% of whom even report that they edit audio or video, at some level, on a monthly basis. Given this, it is very tempting to assume that there is little or no effective barrier to students' uptake of reasonably straightforward learning technology.

Demand: It is not particularly surprising that a large fraction of students report that they would welcome lecture recordings (Gardiner 2011) but this does not appear to be reflected in actual usage figures when the recordings are made available (see also the usage analysis below). It appears that, although students express interest in recordings, they don't have an urgent need for them when the recordings are made available in fact. We speculate that this is because an hour-long recording is not a particularly usable format: it may be useful to provide a 'listen-again' opportunity on a long commute, but the devices that students naturally use to listen to podcasts, being primarily targeted at either music or at podcasts patterned after magazine-style radio programmes, are not easy to use for dipping into, or referring to chunks within, a long recording.

[1] See audacity.sourceforge.net

[2] The distinction between a podcast and a mere collection of audio files is the presence of a 'feed' – an RSS or Atom file – which allows a 'feed reader' application to be automatically notified of the appearance of new 'episodes', so that a user doesn't have to repeatedly re-check the audio source.

Pedagogic utility: Despite the lack of an urgent demand from our intended users, we believe that there is a great deal of educational value latent within lecture audio. This arises partly from its pragmatic use as a revision aid, but also, more fundamentally, because it represents a different modality for instruction, which may complement or in extreme cases replace more traditional textual routes for some students. From this position is it natural to investigate that use of our system within a peer-assisted learning technique such as Jigsaw (Aronson 2013), which members of our team have already successful used within the university; in the event, however, we have not yet had the opportunity to verify our intuitions here.

In summary, therefore, the supply barriers are overall neither negligible nor notably large; the student demand is only diffusely present, but we again believe that rather modest support will elicit this in a more focused form; the pedagogical pressure is still rather vague (in the sense that we as teachers are unsure how best to exploit the resource). Together, these observations suggest to us that a relatively modest technological intervention can have a pronounced and useful – possibly even transformative – effect.

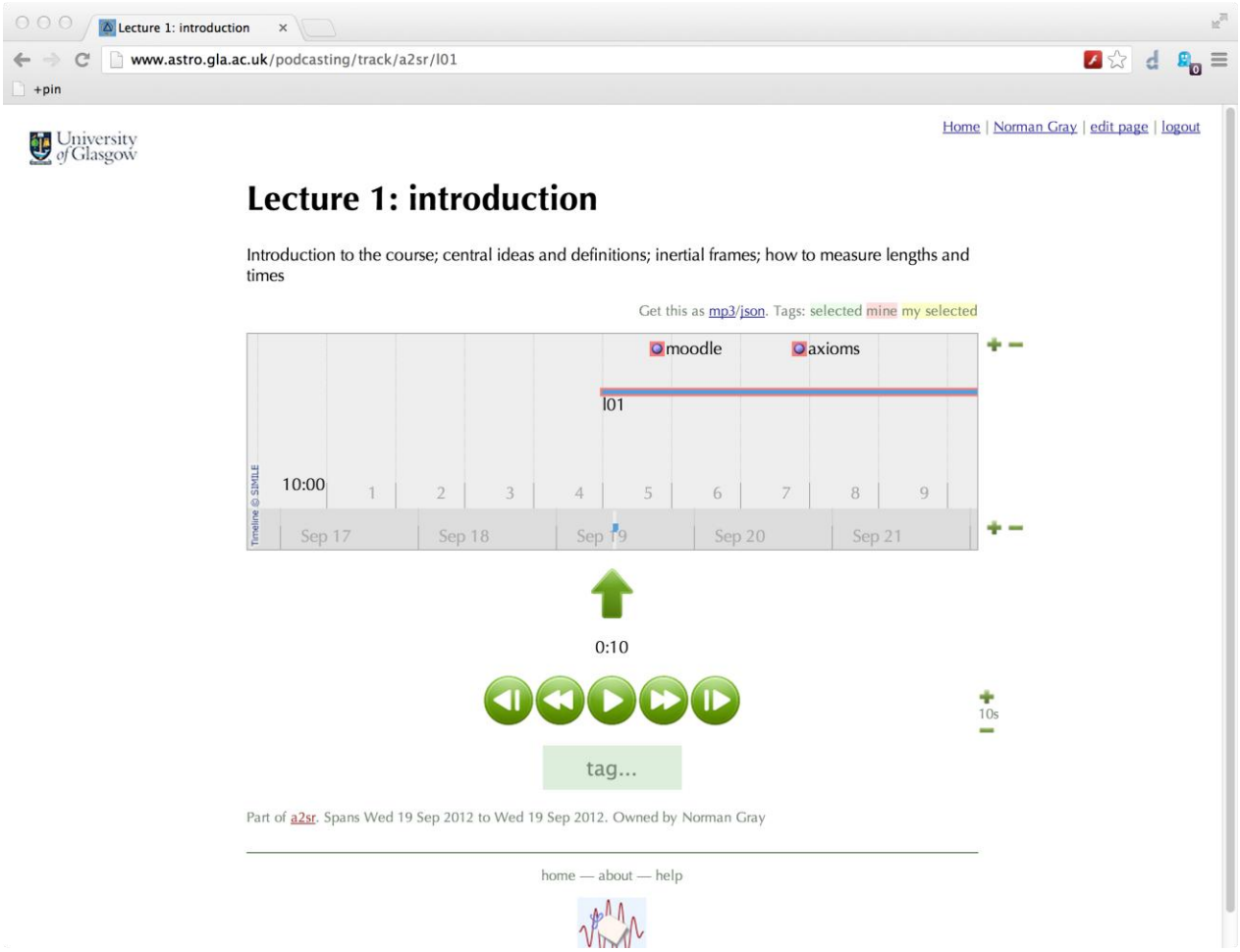
3. The Audiotag system

At the heart of our experiment here is a prototype system, 'Audiotag', developed by one of the authors, which supports upload of audio recordings, distribution of recordings via podcasts, and collaborative user tagging of instants within the audio. The system is currently online at www.astro.gla.ac.uk/podcasting/ [3] and the code is available at https://bitbucket.org/nxg/audiotag/, under an open licence. We used versions 0.5 and 0.6 during the course of the session.

Some of the authors have used an earlier version of this system in previous years, to make recordings available to students in astronomy, but without laying much stress on the tool, or on the tagging functionality it offers.

In the figure below we show the user interface to one of the recordings, showing a recording starting at 10:04 on 19 September 2012, and showing two instants within the opening few minutes tagged with, respectively 'moodle' and 'axioms'; this panel can be scrolled to left and right, and zoomed in and out to show more or less of the recording. The user can play, skip and rewind the audio using the buttons below the display, and add tags to the 'current instant' using the tag box at the bottom. As well, students can 'like' a tag. The system is integrated with the university-wide IT identity system, so that users do not have to register separately for the system.

[3] This is not yet a supported service, so this URL should not be regarded as stable in the long term.



As well as making recordings available to listen through this interface, the system also generates a podcast feed so that users can subscribe to notifications when new recordings are added to a course.

The system has a very simple permissions model: each course has an ‘owner’, who is typically the lecturer; only the ‘owner’ can upload recordings, and only logged-in users can add tags, but we have not so far felt it necessary to restrict access to the audio, so that anyone can download the lecture audio, and view all the tags, without authenticating.

4. Delivering lectures to students – our experimental evidence this year

Two of the authors (NG and NL) have previously used early versions of the Audiotag server to deliver lecture audio to students, in both second year and honours, but without laying much stress on it. Anecdotal evidence suggests that students occasionally used lecture recordings to catch up on lectures they had missed, but most use was at revision time, at the end of the session, when students would listen to complete lectures rather than dropping in to particular instants; several students reported listening to the lectures whilst commuting. There was very little tagging activity in these earlier presentations, but students spontaneously expressed

enthusiasm, both informally and in course-monitoring questionnaires, for the idea of making the lectures available.

In session 2012–13 we obtained money from the Chancellor's Fund – an internal Glasgow University learning development fund – to make the user interface considerably simpler, and to experiment with different ways of integrating the Audiotag server with other pedagogical techniques.

Our hope was that we could use the broad insights of the Jigsaw technique (namely its principled approach to multi-modal group work) to help students enrich their learning by creating links between their own lecture notes, pre-distributed lecture notes, and the audio recordings.

First, however, there is a bootstrap problem. Before we can create any dense and multi-modal network of links to tagged audio, we have to have that tagged audio. Our experience of previous years suggested that this was unlikely to happen spontaneously (even though we believed that we had significantly improved the interface), so we resorted to an apparently reliable alternative: bribery. Part of the Chancellor's Fund support was intended as 'incentives', which in this case took the form of Google Nexus 7 tablet computers as prizes for three of the courses. We studied six one-semester courses, each of which was a coherent block of 10 lectures given by a single lecturer, within a larger full-session course. The collection of courses is as in the figure below.

Code	Course	N	Sem	Year	Prize?
a1cos	Astronomy 1: Cosmology	112	2nd	1	no
sats	Astronomy 2: Stars and their Spectra	69	2nd	2	no
cos	Honours Astronomy: Cosmology	58	1st	honours	no
e1lds1	Exploring the Cosmos: Life and Death of Stars	264	2nd	1	yes
a2sr	Astronomy 2: Special Relativity	69	1st	2	yes
grg1	Honours Astronomy: General Relativity	38	1st	honours	yes

Courses 'a1cos', 'e1lds1' and 'cos' were taught by NL, courses 'a2sr' and grg1 by NG, and 'sats' by another colleague in astronomy[4]. There were five other courses this year where lecturers experimented with the system, and uploaded either a complete or partial set of lectures; in none were the results obviously different from the three 'no-prize' courses listed above.

[4] We are grateful to Matt Pitkin for his willingness to experiment here.

The courses here represent a broad range of students. The 'Exploring the Cosmos' course is a large first-year course which is often chosen as a filler; while the students generally enjoy it and are challenged by it (sometimes more than they expected, under both headings), it is not an academic priority for many of its students. The 'Astronomy 1' and 'Astronomy 2' courses are required courses for students aiming for astronomy degrees. The two honours courses are both quite challenging; in particular the 'grg1' course is optional for the school's MSci joint-Astronomy students and compulsory for MSci Theoretical Physics students; by this stage the students on the honours courses are highly motivated and are in good command of their learning strategies.

In the three 'prize' courses, the class was introduced to the system via an in-lecture demonstration or pointer to the vimeo.com video mentioned above, and told that there was a prize – the tablet computer – to be awarded for the 'best tagger'; after discussion with the class, it was decided that this prize would be awarded to the students whose tags had accumulated the most 'likes' by the day of the course's final exam, in May. In the 'cos', 'a2sr' and grg1 courses, the lecturer added a number of demonstration tags (7, 20, 27 respectively) to the first lecture. In the three 'no-prize' courses, students were introduced to the system, and encouraged once or twice to use it. None of the classes were prescribed any activities specifically involving the tagging system.

4.1 Results

From examining the server logs, we discover the RSS (podcast) feeds for the studied courses were all downloaded on numerous occasions (see figure below); a single subscription would account for numerous downloads. Unfortunately, the server logging available in this version does not allow us to determine how many unique subscribers there were or what the RSS clients were, and all we can say at this point was that we suspect there was only a single subscriber to the 'sats', 'cos' and 'e1lds1' feeds, or perhaps two (so between 0.5% and 3.5% of the respective classes), but that a substantial fraction of the students in the other courses did subscribe to the podcast feeds.

Course	a1cos	sats	cos	e1lds1	a2sr	grg1
N_{rss}	756	34	100	25	8755	14439

However many students subscribed to the podcasts, only a very small number of students have gone on to add tags. In the table below, we list the number of students who added tags, the number of tags that they added, and the number of subsequent tag 'likes'.

Student	Course	Tags (in lectures 1-10)	Total	Likes
KM	e1lds1	4, 5, 5, 6, 5, 3, 4, 6, 0, 0	38	28 by KO, 27 by AR
HP	e1lds1	0, 2, 0, 0, 0, 0, 0, 0, 0, 0	2	1 by KM, 1 by KO

GA	a2sr	0, 9, 0, 0, 28, 16, 0, 0, 0, 0	38	
KE	a2sr	0, 0, 20, 24, 0, 1, 25, 0, 25, 32	127	
SL	a2sr	0, 0, 0, 0, 0, 0, 0, 0, 0, 2	2	
MG	grg1	0, 0, 0, 0, 0, 0, 0, 0, 21, 15	36	2 by MS
MS	grg1	0, 33, 2, 41, 43, 34, 0, 40, 25, 15	233	

The three students who tagged extensively (KM, KE and MS) did so fairly consistently, and the two students who 'liked' most, added no tags themselves. The students appear to have added tags fairly promptly after the lectures, with the exception of KE's, MG's and MS's tags on their respective lectures 9 and 10, which were tagged respectively one, one, and four months after the corresponding lectures.

Our original plan was to use the three first-semester courses to establish a baseline upon which to investigate the effect of other pedagogical interventions in semester two . The surprisingly low response, however, caused us to change our plans, and make the same low-intervention observations again to try to establish a more robust baseline, or to investigate whether there was any difference between the first and second semesters.

5. Discussion

As we discussed in Section 2, we were initially confident that a technically modest intervention would produce a significant effect. This confidence seems to have been misplaced: either the barriers are higher than we expected, or our intervention was more modest than is required.

Interface – general: User interface design is always harder than it appears, and it may be that the interface is simply too hard for users to grasp readily. We think this is rather unlikely, however, since the interface has been considerably simplified from earlier versions of the system, and the informal feedback we have obtained from students has included suggestions for adjustments without giving any impression that there is a major usability problem.

Interface – interaction model: The implicit interaction model, in the current design, is that a student will either review a lecture shortly after it is delivered, or else return to a lecture at revision time, and work through it adding tags. While this deliberate review technique is often suggested to students, we suspect rather few follow it in fact. It may be that this interaction model is more firmly locked in to the system's current interface than we had thought, so that rather few students are prompted to use it in the course their existing study habits. If so, dealing with it would require either a change in the underlying interaction model, or else the introduction of explicit exercises to force the students into interaction.

Over the course of the year, an undergraduate Computing Science student has been working on an alternative interaction model, in which students use a mobile device to add at the current

instant, during a lecture, selections from a repertoire of tags which are pre-set and limited by the system.[5] These tags might represent key moments marking 'I'm lost here' or 'exam', and because they are added while the user is already interacting with the lecture audio (as live speech rather than as a recording), they might evade the model-related problems described above. Tags such as 'I'm lost' are probably most comfortably kept at least semi-private; this requires a non-trivial server change, and so while this approach is promising, it was not possible to fully develop it in this prototype cycle.

One way to align the system's model and the students' is, as above, to change the system. An alternative is to change the students: we have designs for specific exercises which (for example) require the students to make explicit the links between course handouts and lecture audio, so forcing an increase in the number of tags, and thereby intended to create enough value in the set of tags, that students will interact with the tags completely enough that they cross a threshold to spontaneously adding more.

Unfamiliarity: We have supposed that students would be sufficiently familiar with the concept of tagging online content, through their experience of existing 'Web 2.0' services, that tagging audio would require no introduction, little training and only mild encouragement. It is not obvious that this is false, but until we have ruled it out, we must consider the possibility that we simply did not introduce the system clearly enough, so that the students failed to understand what to do. If so, this would be a depressingly simple explanation for the lack of engagement.

Incentive: The incentive we used on this occasion was a reasonably generous prize. Although the nature of an incentive can sometimes have paradoxical effects on the response, the results above indicate that the courses where there was tagging activity are precisely the courses where a prize was offered, so the prize does seem to have had its intended effect (albeit less pronounced than we expected).

Overall, this project was a technical success but so far puzzlingly disappointing in its outcomes. We initially believed we had rather small barriers to overcome, dividing students' current practice and interest from the benefits latent in an easily-obtainable audio resource. We expected that we would readily see rather natural use of the tagging facilities in the various student populations, so that we could promptly go on to investigate how this use was changed by pedagogically motivated exercises. The results of our investigation suggest (i) that the barriers are higher than we have described in Section 2, or (ii) that we have a poor model of how audio tagging fits in to students' current practice, or else (iii, which is not a completely separate issue) that the 'natural' level and pattern of tagging, and the pattern of tagging produced by lecturers' exercises, are more fully decoupled than we might imagine.

In the coming session we plan to repeat the experiment with a modified interface and a clearer notion of the place of lecturer-driven exercises, in order to better investigate the shape of the barriers between students and the latent value of lecture audio recordings.

[5] We thank Melissa Campbell for her contributions to the project.

References

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