Planning multimedia documentation

DAVID NATHAN

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Developing multimedia documentation

David Nathan

1.   Introduction

This paper describes some of the issues and processes in initiating, planning and developing an interactive multimedia CD-ROM for an endangered language (EL). It provides some guidance for dealing with issues that are not normally faced by linguists. It is beyond the scope of the paper to detail the skills required for preparing data or creating usable applications (such as media editing, data processing, or multimedia authoring). However, often the greatest difficulty faced by linguists is to identify *which* skills are needed — skills they may need to acquire or get assistance with. The focus here is on the *Paakantyi* CD (Hercus and Nathan 2000), and the interweaving of planning, community participation, and a team approach in its construction. Paakantyi is the language of the lower Darling River, south-western NSW, Australia. While Paakantyi no longer has any fluent speakers, the input of Paakantyi people had a profound influence on shaping the CD's design and content.[1]

2.   Documentation, archiving and multimedia

Many linguists have become aware of the deficiencies in current practice in handling endangered languages data. These deficiencies fall under three broad headings:

- *documentation* of a broad range of linguistic phenomena (cf. Himmelmann 1998, Woodbury 2003)

- *archiving*, including the preservation and access to data (cf. Bird and Simons 2003, Johnson, this volume)

- *mobilisation* of materials into usable resources for practical language support (cf Nathan 2003)

There is considerable confusion and debate about how to successfully conduct these three types of activities. Firstly, at least, it is crucial to distinguish them, as they have different and even opposed aims. For example, we often hear researchers proposing to "archive the data on the web", perhaps looking for a way to simultaneously achieve all of (1), (2), and (3). However, the web uses data formats that are not optimal for archiving (it is a publishing context, in Johnson's terms); more generally, the web is probably the most unstable information system in use today.[2] Communities and

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[1] I am grateful to Luise Hercus for comments on a draft of this paper.

[2] For example, typical current estimates for the lifespan of an average web page range from 44 to 100 days. Even pages that persist are commonly subject to undocumented changes in content or changed URLs.

language consultants also may resist the idea of using the web to provide free and universal access to their EL data. Since most ELs are endangered due to social, political, economic or conflict reasons, many communities are sensitive about releasing or exposing what may be some of the last vestiges of their distinguishing identity. In today's EL research and documentation, community participants must be able to understand the potential outcomes of the work; if they know that materials will be freely and unqualifiedly disseminated, it may discourage collaboration or reduce the amount of language material that they allow to be collected (Nathan 2004b).[3]

Mobilisation of linguistic material has received less attention than documentation and archiving, probably because it requires linguists to play an active role in the invention and evolution of genres for presentation of linguistic knowledge, something that linguists are, paradoxically, generally poor at. Such new genres are difficult to work in because they involve team participation by people with a range of skills (Csató and Nathan 2004), exacerbated by the tendency of linguists to work alone.[4]

Mobilisation is even more urgent than the other two needs where languages are ceasing to serve social and cognitive functions, and if communities have justifiable demands for linguists' support in shoring up languages while some last full speakers remain healthy. Actual efforts by language experts to counteract language endangerment and (impending) loss reflect the sincerity of our claims, and multimedia provides a very effective way to mobilise language materials.

Multimedia development provides opportunities for language documentation as well. Its advantages over static, written materials, such as the ability to present sound as an integral component of the materials and results, are profound for linguistics. Multimedia helps to focus project design on the variety, quality, and authenticity of language events and performances, thereby supporting a framework for creating rich language documentations that can be used for a variety of purposes (Himmelmann: 1998). Multimedia typically means multi-skills and therefore requires the participation of several people; it puts linguistic work into a team situation and exposes it to the expertise of others such as designers, teachers, and programmers. Using multimedia can provide the motivation and contexts for encouraging community participation in producing language documentations. Existing 'legacy' materials can be given new life by using them as assets in a multimedia product.

On the other hand, working with multimedia poses many challenges. The diversity of inputs can create problems in dealing with intellectual property rights, and

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[3] Current ethical principles governing much linguistic work include informed consent of language project participants (see also Johnson, this volume). In addition, there is growing appreciation of rights to privacy. See, for example, AIATSIS 2000.

[4] Linguists do work collaboratively on some activities, such as the publication of papers and books. Here, the maturity and transparency of the roles and relationships in traditional publishing make the complexities of the collaboration between linguist, software, editor, designer, typesetter etc. almost invisible.

there are a range of issues to do with the complexity of construction, interaction design, asset file formats, product performance, and high demand for storage space and transmission bandwidth.

Multimedia materials are not easily archived. Because multimedia typically requires delivery via specialised (often proprietary) software, there are specific and possibly short-lived requirements for particular data and file formats, software versions, operating systems, and platforms. Nevertheless, arguments against producing multimedia on these grounds are weak. There are fundamental challenges to be faced in *any* contemporary use of digital media for documentation: the instability of open-standard media file format specifications, a lack of conventions for describing and building interfaces, and the fact that it is not yet known how to represent and archive abstract content such as navigation, layout, links and interactivity. These limitations mean that choosing to work with multimedia is a result of recognising its advantages for language documentation and language strengthening projects, rather than being a broad strategy that can satisfy various other needs such as long-term data preservation.

3.   Planning

Multimedia projects are typically more time consuming and expensive than other activities; compared, eg. to producing an edited collection of papers, one would have to add other factors such as that the participants' backgrounds, skills and materials vary widely, and their contributions are to be intertwined in the product. Therefore, a clear conception of the type and scope of the product, and the resources available, are required.

Community initiation, support, and ongoing participation are important ingredients. Ethical and protocol considerations are highlighted when working in multimedia because it provides a more direct channel between the information providers and the product's audiences. See AIATSIS 2000 for a good general ethical framework for working with indigenous communities.

Here are some of the factors to be considered when writing a plan or a funding application:

- community initiation of the project or level of support for the project's aims
- the researcher's understandings of the language situation, including amount of usage, its resources, and the level of interest in the language in the community and education sector
- the available community contacts, relationships with them, and their accessibility
- the availability of professional colleagues and their interest/skills in multimedia

- other resources in the community, e.g. sources of skills or materials for art/graphics, and music; links to educational and other institutions

- the availability of relevant assets e.g. dictionary, texts, recordings, photographs

For example, the *Paakantyi* CD (Hercus and Nathan 2002) was produced by the author and Dr Luise Hercus in response to perceived language needs within the Paakantyi community and following discussions with community members. This took place in a fertile context; language revitalisation was beginning among the Paakantyi and was already gaining momentum across New South Wales, and this was coupled with promotion of access-enhancing language projects by the Aboriginal and Torres Strait Islander Commission (ATSIC, the main national Indigenous organisation), as a result of attention to issues of Aboriginal languages and identity following the Royal Commission into Aboriginal Deaths in Custody (Commonwealth of Australia: 1991).[5] Figure 1 shows our original statement of aims for the Paakantyi CD as submitted to ATSIC.

> *Aim*
> To produce, by collaboration between community, linguist and software developer, an interactive multimedia CD for the Paakantyi language that will:
> - provide a resource for Paakantyi language teaching
> - record and archive existing language resources
> - generate new language resources
> - generate enthusiasm for language activities
> - provide an introduction to multimedia production for community participants

Figure 1 Paakantyi CD: the original rationale for the project in the funding submission

The language community should be designated as a major target audience for a multimedia product. Not only will it probably be a valuable resource for them, but also community participation at all stages is crucial to the construction of meaningful and authentic multimedia materials. Funding and other available resources should be used to make a *new* contribution to language and community resources, rather than use a new format to dress up something that is already available.

How can you decide on the content of a multimedia resource, especially when it may be influenced during the course of the project by evolving ideas and a changing scope of collected materials? The first decision to make is whether you should use existing materials as the project's primary assets, or generate new materials. Generating new materials is preferable; it allows the results to be distributed more broadly (because the project and participants will probably have intellectual property rights in the materials), and enables planning and development work to take place within the

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[5] ATSIC was established in 1989 and has recently been abolished by the Federal Government led by John Howard.

community, thus providing more opportunities for input, interaction, and the development of a 'biography' of the project within the community itself (Csató and Nathan 2004). Newly recorded sound material is also likely to be more consistent and of better quality.

Some (e.g. Rood 2004) have argued that the richness of older language sources gives them higher priority than new recordings of lesser-accomplished speakers. Considered in a vacuum, this might be valid; however, multimedia production has to take into account socio-political realities in communities (which will largely determine how accepted and effective the eventual product will be), and accepted media production methodologies (where quality and consistency of presentation also determine the effectiveness of the product).

4.   The team

Multimedia means multi-skills and usually a project will be run by a team of people with a variety of roles and skills. There are four main roles. Firstly (because this is probably you, the reader), there is the linguist, someone with skills and experience in relevant areas of linguistics including language description and documentation, sociolinguistics, lexicography etc.. The linguist should have a good background not only in the language, but also with the community, and its local history, social life, and etiquette — in other words, the linguist ought to be a specialist, not a 'generic' linguist. Secondly, community members should take various roles — as speakers/consultants, artists, recordists, advisors, and liaison. The community category may also, where appropriate, include people who have 'married-in' to the community, and may be extended to include local enthusiasts, teachers, and clerics etc. Thirdly, there will be a software developer or 'IT' person, typically a multimedia developer rather than a business application programmer — this person may work closely with the linguist, or may co-ordinate the project.

Finally, you should engage a graphic designer. One of the pitfalls in conceiving multimedia materials is to imagine that merely adding in some sound or graphics can transform what you ordinarily do into a multimedia product. In deciding to make a multimedia product you are entering the realm of an entirely different genre, one that is populated with carefully designed and often richly interactive titles such as computer games. Therefore, do not attempt to make a significant multimedia product without a graphic designer. Professional graphic designers know how to interpret the project brief and your materials in order to create screens that will enable your product to achieve its aims. Furthermore, a designer will bring style and individuality to the project, and will most likely make valuable suggestions about interactivity and matters surprisingly relevant to the linguistic content.

It is not necessary to find a graphic designer who has a lot of experience designing multimedia or websites; it is more important to find a good, professional

designer who is motivated toward your project than one who is widely experienced in digital media. Provide your designer with overviews, examples, storyboard ideas (see below), and a large amount of assets such as photos, artwork, and ask them to come up with a design concept.

As with other members of the team, you will need to 'go halfway' with your designer, for example, by learning some specialist terminology, by using common software, and by efficiently exchanging materials. Be open and be honest about your skills and aims, but give in very easily to the designer's advice on design issues.

Take care to avoid over-design at the expense of depth of content and interactivity — a telltale sign of over-design is that the deeper you navigate, the less content and interactivity there is. Make sure that the designer does not bring stylised notions of the language community to the project.[6] It is easy to avoid inappropriate representations by seeking community members' input on art and design, and by delivering regular draft versions of the product to the them for evaluation. Typically, you will work together with the designer and the multimedia developer to design the interactivity, and to deal with issues such as fonts or deciding whether text on the screen should be 'live' (selectable/clickable) or graphic.

In some circumstances you may have the resources or the luck to have access to other skills, such as instructional or pedagogical design.

In a good team, there will be differences of opinion, but members will find it possible to defer to the views of the member primarily responsible for a particular area. Typically, the linguist and language consultants should have final say on linguistic issues, and the graphic designer should make the aesthetic decisions.

5. The cost

People often ask how much it costs to make a multimedia CD-ROM. This question is impossible to answer generally because CDs vary enormously in scope. Practitioners' costs vary widely too; design and multimedia authoring can be expensive but on the other hand many projects are completed through the unpaid efforts of people dedicated to completion of projects where the funding is limited.

Budgets should take into account payments to community members for language work, artwork licensing, liaison, and other contributions. Remember too that CDs are 'media hungry' — they typically require many images, which must be sourced and paid for (to photographers and artists, or for royalties/licences). These images still need

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[6] For example, some designers seem to have believed that Indigenous people need graphics of landscape objects such as rocks and animals for navigation buttons. However, multimedia has its own conventions (some of them closely related to standard software conventions) and users are not helped by attempts to simulate realities using absurd associations.

graphic design work to adapt them for the product. Projects may also include activities such as on site workshops which may be expensive to organise and run.

Nevertheless, here are rough figures for some project budgets. The Paakantyi CD received about $A50,000 (£20,000) funding from ATSIC, which was mostly used for fieldwork, salary, language and art input from the community, software, and graphic design. Most of the content and time supplied by Luise Hercus was unpaid, and a significant proportion of the funds were retained by the host institution AIATSIS. The *Yolngu Languages and Culture: Gupapuyngu* CD (Christie et al 2001) cost a similar amount to develop; again, not including the time spent by academic colleagues developing materials over several years prior to the project. The *Spoken Karaim* CD (Csató and Nathan: 1998) was funded through approximately one year's salary for the developer (Nathan) and a direct grant to the graphic designer. Much of the material, such as recordings of speakers, transcriptions etc. was also created by the linguist prior to the project. However, it was a complex, innovative software project, with development taking well over two years.

6.   Storyboarding

Storyboards originated in cinema production; they basically describe graphic change over time. Storyboarding is even more important for multimedia projects, because the conventions of multimedia are underdeveloped compared to cinema.

Figure 2 Storyboards originated from cinema: storyboard fragment from 'What Goes Around', (First Light) http://www.firstlightmovies.com/storyboard.php

Storyboarding is typically done initially by the multimedia developer and the linguist, with later input from community members and the designer. Although it is a time consuming process, storyboarding fulfils many functions. It provides a gentle, non-threatening way to begin the design process and to flesh out and solidify ideas. It provides a forum for negotiation of the project's scope and boundaries/limits, for identifying omissions or problems, and for bringing together disciplines. Storyboarding is the phase of the project where participants check interpretations of terms and develop shared understandings of concepts and terminology. In fact, it is a good strategy to use

the storyboarding phase to develop a shared nomenclature for the project's objects, sections etc.

Later, the storyboard becomes the actual blueprint that the designer and multimedia author will follow. Here are some hints for getting started and creating storyboards:

- first, review products that are similar to what you imagine developing; view them in a team situation and say what you like and dislike about each one

- don't take storyboarding too seriously at first; just start drawing out screens on large sheets of paper, starting with the "splash" or opening screen

- your storyboard should describe the *functional* content and *behaviour* of the product, not the graphic design and layout. Your graphic designer will interpret the storyboard to make a design

- you need to deal with every single functional object you want to see on the screen and every conceivable navigation that the users will make — fudging or hand waving will cause difficulties later

- make sure that the following aspects are fully described: number of major areas/divisions, menu structure, main active data objects (e.g. scrolling clickable lists, other controls). Typically you will have a menu that corresponds to the major areas in the product; it usually also includes Help, Home, Settings/Preferences, Quit, and perhaps Forward and Back (Forward and Back are challenging to implement in interactive multimedia)

- remember to deal with sounds — when and how they start and stop playing

- typically you will underestimate the amount of linking and interactivity that good multimedia should have

- there should be *more than one way* of doing most things (e.g. navigating, issuing commands, making choices)

- work alternatively top-down and bottom up — don't spend too long on either perspective

- many types of changes may still be made later. These can be made in reference to the original storyboard. Typically, some components will be added, and some not implemented

- ensure that the developer does not divert the linguist from linguistic aspects; on the other hand, encourage the developer to alert the linguist to possibilities that he/she may not have thought of

- beware the temptation to have a set of screens that are predominantly static or appear in a fixed order; this is a sign that you are making a training video rather than an interactive resource
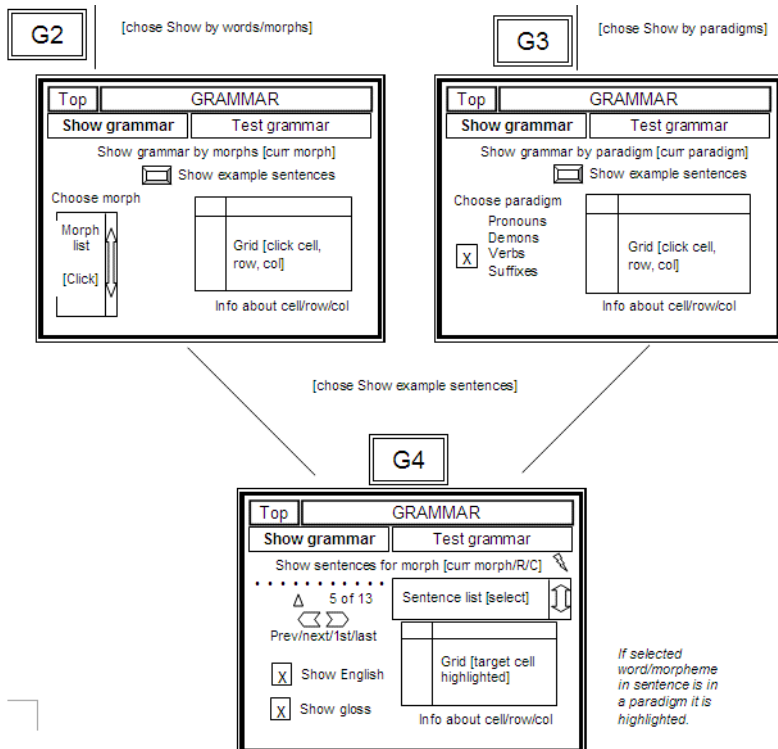
Figure 3 Example — fragment of storyboard for the Gupapuyngu CD

7.   Recording sound

Sound is challenging to acquire, process, present, distribute, and archive. Methods for handling and presenting sound remain a major gap in the emerging field of language documentation.

   If you are making new recordings, pay the most attention to microphones, the 'ears' of your project. Microphone selection and usage is an area where linguists have typically been underinformed.[7] But even before plugging in a microphone, the fieldworker should carefully consider the physical environment and human context — these will affect not only the quality of the recordings but also the smooth running of the sessions and the happiness of the participants. The best place to record is in a

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[7]   For guidance on microphone selection and usage, see the information sheet at http://www.hrelp.org/archive/advice/microphones.html

recording studio. You should consider spending some of the project funds on travel and accommodation for language speakers so that they can work with you in a studio. You may find a local radio station not far from the fieldwork area that has suitable facilities and is willing to let you use them. Simpler strategies can also work: for the Paakantyi project we stayed at a motel in a centrally-located village. We rented an extra motel room so that one of the main consultants who lived more than 100km away could stay together with us (she could also use the opportunity to visit family and do shopping). Recording in the motel (in my room!) meant that we could work flexibly, we could avoid some of the noise and interruption that inevitably occurs at people's houses, and we could better control the recording environment without intruding on the integrity of people's homes (eg. we were able to turn off the refrigerator and move the furniture).

Strategies for making good recordings are covered elsewhere; here it suffices to make three points that will determine your ability to make recordings suitable for interactive multimedia:

- *digital recordings* (high quality, low-hiss) are best because multimedia will typically be used on computers which emphasise high-pitched sounds;

- *microphone* selection and location is the most influential factor in determining the quality of recordings;

- *consistency* (of volume, quality etc.) is crucial in interactive multimedia, where sounds will be encountered in unpredictable orders and juxtapositions. Extraneous noises should also be avoided.

There are many other issues to consider in dealing with sound, such as recorders, backup, digitisation and data processing (described below), and designing and programming interfaces for access and control; however, observing the three points above should make sure your team's recording efforts provide acceptable sound assets for a multimedia product.

8.   Processing of recordings

This section describes how recordings were handled in the construction of the talking dictionary component of the *Paakantyi* CD.

In the field or immediately after our return, the recordings (made on Sony minidisk) were redigitised using a desktop computer with a good quality sound card, to produce 44 KHz/16 bit/mono .wav files (which correspond to CD quality, except mono).[8] Each session (minidisk track) corresponded to one sound file whose name

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[8] It would have been slightly better and possibly easier to use a full-sized MD deck to do direct digital recording (our portable minidisk only had analogue output). However, this is not worth taking trouble over in many cases; redigitisation (ie DA-AD) results in imperceptible loss of quality if reasonable quality equipment is used carefully.

identifies the original session (eg. PMD3-2.wav was the second session on the third minidisk — see Johnson, this volume, regarding the importance of consistent naming conventions). These files were then written to data CDs.

Next we needed to transcribe or at least classify the content of the sound files. This was a task for the linguist, Luise Hercus, and to save her having to listen to more than 10 hours of recording, much of it with no useful material, I made a rough edit and condensed all the segments containing potentially useful material into four CDs. Each of the segments was named to retain a link to the original session (eg. PMD3-2_ed.wav was the edited/condensed version of PMD3-2.wav).

Luise transcribed the condensed material, also time annotating her transcription with time offset values and comments about potential usage of words and phrases — see Figure 4.[9]

transcription	sound offset	type	gloss	speaker
nhumparka that's green	022	lex+gloss		IM
wiirpa	042 or 43	lex	cloth	LW/IM
yarra	043	lex	tree	LW
yarra is a tree and kamara means gum	052	lex+gloss		LW
kurkuru	054	lex	box tree	LW
kurkuru yarra, that is where you used to get the grubs from when you couldn't get them from the gum tree	055	lex+gloss		IM
thuluru kunti partaana	117	sentence	many mosquitoes are biting	IM-LW
muni-muni	125	lex	green ant policeman	LW
wiikilaana	129		?	IM
you can talk.. yarnta too, you got any yarnta	135	gloss		IM
kaankuru	138	lex	horse	LW
thartu-pulyki	145	cpd	head-hair	LW

Figure 4 Example from annotated transcription database for Paakantyi *CD's talking dictionary*

Luise's annotated transcriptions were then processed and entered into a database that had previously been created and seeded with data from her published Paakantyi Dictionary (Hercus 1993). Further tables and fields were added to the database as we

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[9] This could also have been done using software such as the *Transcriber* program (http://www.etca.fr/CTA/gip/Projets/Transcriber/); however, it is the data structures that are important, not the software used to create them, and Luise preferred to use a simple sound editor to get the time offsets and write the data into tables in a word processor — a process that was familiar to her and resulted in well-structured data for import into a database.

built up the data that would eventually support linking the dictionary text, sounds, and example phrases/sentences (see Figure 5).

ID	Section	file src	form	gloss	DicID	type	speaker	comment
16	S1	116	thuluru	a lot, many	1741	l.	LW	
17	S1	117	thuluru kunti partaana	many mosquitoes are biting		sentence 2094, 433, 1741	IM-LW	
18	S1	125	muni-muni	green ant, policeman		l. ALSO 724	LW	25 JUNE REPEATED IN 746
19	S1	129	wiikilaana	?			IM	
20	S1	132	yarnta	stone, money	2152		IM	
21	S1	135	you got any yarnta?			gloss 2152	IM	

Figure 5 Database in transition, assigning sound assets for use as entries or examples

Full details of the database work are beyond the scope of this paper. We evolved data of the type shown in Figure 5 into discrete, normalised tables (a fragment is shown in Figure 6) that could be imported into the multimedia application. Notice how some of the data in the second data row of Figure 5 (ID 17) has been represented in Figure 6 as rows that each correspond to some association or action. In Figure 6, each row corresponds to a use of an item (identified by its SoundID in the second column) as an example for an entry (identified by its LexID in the third column) in the talking dictionary—see Figure 7.

ID1	SoundID	LexID
4	17	1741
5	17	433
6	17	2094
8	21	2152
9	24	1602
10	24	1404

Figure 6 Fragment of a derived, normalised table

The time offset data was used to locate the sound segments to appear in the CD. We created individual files for each item, naming them carefully according to a

predesigned schema, and storing the filenames in the database.[10] In a small number of cases, detailed sound editing was done, e.g. to replace syllables that had noise intrusion such as paper shuffling with a suitable syllable from another item. All sound files were then prepared as assets for interactive multimedia:

- fade in / fade out of each item (*high priority*: so that transitions and juxtapositions are always smooth, and items do not cause clicks or thumps when they start or end playing)[11]

- normalise sound volumes of some items (*medium priority*: some sounds were rather quiet)[12]

The remaining steps involved exporting the sound linking data from the database into the multimedia application, programming the way that sounds were accessed and controlled, and integrating the lexical data and the dictionary graphics produced by the graphic designer.

Figure 7 Screenshot of Paakantyi CD's talking dictionary

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[10] Today, the computational environment for sound has changed such that it is no longer necessary to make individual sound files for each playable item, but rather to store the whole sound, together with time offset data for the start and end of segments.

[11] The same result can now also be obtained in high-end multimedia authoring software such as Macromedia Director through scripted control of playback qualities of individual sound files or segments of sound files (see previous footnote).

[12] We also applied noise reduction processing to some items, but this was of low priority. Noise reduction is usually not worth doing unless professional equipment and a knowledgeable operator are available.

9.   Conclusion

This paper has discussed various steps in planning and developing a multimedia CD. Although many other activities are required to bring a CD to completion, positive outcomes can be expected of projects that successfully undertake the steps described here, including:

- a multimedia resource meeting some of the community's language needs

- a resource for assisting language teaching programs at local schools

- raised community awareness of and interest in the language

- creation of innovative products (e.g. in the case of the *Paakantyi* CD, the first talking dictionary and talking crossword of an Australian Aboriginal language)

- generation and publication of new language materials

- documentation of previously unrecorded words and expressions

- development of new interfaces for presenting language materials

- financial rewards for language consultants and artists

Relationships between stakeholders, and the quality of the product, will be optimised if the planning and development process is concrete and open. By exposing product planning and evolution to the community you can not only get valuable feedback about design, content, and usability,[13] but also build a local 'story' — a biography — for the eventual multimedia product. The community's relationship with it when it emerges will most likely enhance its acceptance and usage, thereby best supporting the aim of such documentations: supporting communities in their efforts to maintain/revive their languages.

10.   References

AIATSIS (2000). *Guidelines for Ethical Research in Indigenous Studies*. http://www.aiatsis.gov.au/corp/docs/EthicsGuideA4.pdf

Austin, Peter K. and David Nathan (1996). *Kamilaroi/Gamilaraay Web Dictionary.* http://coombs.anu.edu.au/WWWVLPages/AborigPages/LANG/GAMDICT/GAMDICT.HTM

Bird, Steven and Gary Simons (2003). Seven dimensions of portability for language documentation and description, *Language* 79/3: 557-582.

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[13] For example, we were able to get (positive) evidence about the usability of the crisp, text-based interface that our graphic designer had provided.

Christie, Michael, Waymamba Gaykamangu and David Nathan (2001). *Yolngu Languages and Culture: Gupapuyngu*. Faculty of Aboriginal and Torres Strait Islander Studies, NTU [Multimedia CD-ROM]

Csató, Éva A. and David Nathan (1998). *Spoken Karaim* (L version). Tokyo University of Foreign Studies. [Multimedia CD-ROM]

Csató, Éva A. and David Nathan (2004). Multimedia and documentation of endangered languages. In Peter K. Austin (ed.), *Language Description and Documentation, Vol 1*, 73-84. London: SOAS.

Commonwealth of Australia (1991). *Report of the Royal Commission into Aboriginal Deaths in Custody* (Volumes I-V).

Hercus, Luise A. (1993). *Paakantyi Dictionary*. Canberra: L.A. Hercus

Hercus, Luise A. and David Nathan (2002). *Paakantyi*. Multimedia CD-ROM. Canberra: ATSIC.

Himmelmann, Nikolaus P. (1998). Documentary and Descriptive Linguistics. *Linguistics* 36: 161-195.

Nathan, David (2003). Endangered languages documentation: from standardisation to mobilisation. Paper presented at Digital Resources for the Humanities, Cheltenham, England, September 2003.

Nathan, David (2004). ELAR — Reconceptualising the Digital Archive as Ark-hive. Paper presented at the Annual Conference of the Australian Linguistic Society, University of Sydney, July 2004.

Pawley, Andrew and Frances Syder (1983). Two puzzles for linguistic theory: native-like selection and native-like fluency. In J. Richards and R. Schmidt (eds.), *Language and Communication*, 91-226. London: Longman.

Rood, David and A. Mirzayan (2004). Are new digital recordings always helpful in the preservation of Severely Endangered Languages? The Case of Wichita. Paper presented at *A World Of Many Voices: Interfaces in Language Documentation*, University of Frankfurt, 4th - 5th of September, 2004

Warschauer, M. (1998). Technology and indigenous language revitalization: Analyzing the experience of Hawai'i. *Canadian Modern Language Review*, 55(1): 140-161.