Australia Loves Language Puzzles: The Australian Computational and Linguistics Olympiad (OzCLO)

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Abstract

The Australian Computational and Linguistics Olympiad (OzCLO) started in 2008 in only two locations and has since grown to a nationwide competition with almost 1500 high school students participating in 2013. An Australian team has participated in the International Linguistics Olympiad (IOL) every year since 2009. This paper describes how the competition is run (with a regional first round and a final national round) and the organisation of the competition (a National Steering Committee and Local Organising Committees for each region) and discusses the particular challenges faced by Australia (timing of the competition and distance between the major population centres). One major factor in the growth and success of OzCLO has been the introduction of the online competition, allowing participation of students from rural and remote country areas. The organisation relies on the goodwill and volunteer work of university and school staff but the strong interest amongst students and teachers shows that OzCLO is responding to a demand for linguistic challenges.

1. Introduction

The Australian Computational and Linguistics Olympiad (OzCLO, www.ozclo.org.au) began as an idea in late 2007, largely prompted by a parent in Ballarat, a small town in Victoria, who came across the North American competition (NACLO, Radev et al. 2008, see also Derzhanski and Payne 2010) on the Internet and thought it was something that her daughter would be interested in doing.[1] Her emails to the organisers of NACLO, asking about the likelihood of such an event being run in Australia, led to initiating contact with the Australasian Language Technology Association (ALTA) with the suggestion that a computational linguistic olympiad be established in Australia. Dominique Estival (then at Appen Pty Ltd and a member of the ALTA Steering Committee) took on the project and, jointly with Jane Simpson (then from the University of Sydney), Rachel Nordlinger and Jean Mulder (from the University of Melbourne), ran the first ever Australian Computational and Linguistics Olympiad in 2008, with financial support from the Human Communication Science Network (HCSNet), and help from ALTA, the Australian Linguistic Society (ALS) and the Commonwealth Scientific and Industrial

Research Organisation (CSIRO). The first competition was held in two locations – the University of Melbourne (Victoria) and the University of Sydney (New South Wales) – with a total of 119 students participating from 22 schools. Given the success of this first competition, 2009 saw the addition of four new locations around Australia (Adelaide, South Australia; Brisbane, Queensland; Canberra, Australian Capital Territory; and Perth, Western Australia) and the participation of the national winning team at the International Linguistic Olympiad (IOL) in Wroclaw, Poland. Since then, OzCLO has run every year, with the recent addition of two regions (NSW–North in 2010 and Northern Territory in 2013) and the participation of an Australian team in IOL each year.

The OzCLO competition is available to high school students in years 9–12, who participate in teams of four. The competition has two rounds: the first round, in which teams compete against others in their state or region, followed by the national round for the top placed teams from each state or region. The first round is run in both offline and online formats. The structure of the competition is discussed in greater detail in Section 3, and the development of the online format is discussed further in Section 8.

2. Philosophy, Aims and Principles

The immediate aim of OzCLO (Simpson and Henderson 2010) is to introduce high school students to language puzzles from which they can learn about the richness, diversity and systematic nature of language, and develop their reasoning skills. The general value of this type of knowledge and skills in high school education has not been specifically articulated to potential participants or their teachers, schools or parents, as it has in the UK (UKLO 2011; Hudson and Sheldon 2013). However, informal feedback and the strong participation rate both indicate a widespread perception in the Australian school sector that this type of activity has educational value, albeit with different foci in different schools. For many of the schools that participate, OzCLO provides a means to meet their institutional responsibility to provide extracurricular activities that are intellectually stimulating and broadening for academically high-achieving students (under rubrics such as 'gifted and talented'). Some schools offer OzCLO to a wider range of students.

The broader aim of OzCLO is to promote awareness of, and interest in, linguistics and computational linguistics in high schools and in the wider community and, more specifically, to increase enrolments in these disciplines at university level. A further goal is that this will ultimately attract people to careers in these areas. Linguistics has traditionally had little recognition at high school level in Australia, even within language education, although more recently there is linguistics content at upper high school level in the English Language course in Victoria (offered at years 11 and 12; see Mulder 2007) and in the new national English curriculum (www.australiancurriculum.edu.au/English/Rationale). Despite the multiethnic diversity of the Australian population, with slightly more than one in four people born outside Australia, the 2011 census found that 81% of Australians aged 5 years and over spoke only English at home while only 2% did not speak English at all (Australian Bureau of Statistics 2012). Furthermore, the enrolments in courses in languages other than English in schools and universities have declined dramatically since the 1960s (Lo Bianco 2009). Pauwels (2007: 111) states that the numbers of high school students learning a foreign language dropped from 40% in the 1970s to 16% in the early 1980s. Lo Bianco (2009: 48) reports that a mere 10.3% of final year high school students across the nation were studying a second language in 2006. Given this predominantly monolingual context, the level of participation and interest in the OzCLO competition has been extremely positive.

Consistent with the key aim of promoting interest in languages and linguistics, OzCLO operates on the principle that participation should be fun and offer achievable, if challenging, tasks to a broad range of students with interests that span across science and humanities. The cross-cultural content arising from problem sets focussed on a wide range of the world's

languages (see Section 5), combined with the analytical skills required to solve the problems, means that the competition appeals to humanities and science students alike and serves to 'bridge the "techie/fuzzy" divide that characterizes increasingly specialized academic cultures' (Derhanski and Payne 2010: 214). An important feature of all OzCLO problems (and indeed, of Linguistics Olympiads internationally, see Derhanski and Payne 2010: 215) is that they can be solved deductively as stand-alone problems and do not depend upon any previous knowledge of linguistics or the languages involved. This ensures that the competition is accessible to all high school students, irrespective of their educational background. Nonetheless, some training is provided before the first round in order to initiate prospective students into the kinds of problems they can expect to solve in the competition and introduce a range of strategies to help solve them. The nature of this training is discussed in more detail in Section 6.

3. The Structure of the OzCLO Competition

The OzCLO competition consists of two rounds, a regional or state-wide first round and a national round. In both, school-based teams of up to four students attempt to solve five or six linguistic problems in two hours. The teams are divided into senior and junior sections, with the senior teams drawn from the last two years of high school (years 11 and 12), while the junior teams are drawn from the two preceding years (years 9 and 10). The same problem sets and competition conditions hold for both senior and junior teams. The top three teams (whether junior or senior) from each region are invited to go on to the national round, which is held under the same conditions. If the top junior team is not in the overall top three teams, then it is also invited to the national round (in this case, there are four teams representing the relevant region at the national round). The team which wins the national round is invited to represent Australia at the IOL, with OzCLO covering the IOL registration fees and accommodation costs and contributing to airfares (funds permitting). The second-placed team in the national round is given the opportunity to also attend the IOL on a self-funded basis.

For the first round, schools participate in either an offline or online format. The offline competition is held at the local participating university and requires students to come to the university campus to take part. Students participating online do so on their school grounds, supervised by a teacher. The sets of problems and the competition design are identical in both formats (except that students participating online enter their answers on a computer, whereas those participating on-campus (offline) write their answers in an answer booklet). Most regions offer both offline (on-campus) and online options; some regions offer online only. The development and running of the online competition is discussed in more detail in Section 8.

In both rounds of the competition, participation takes place in school-based teams, rather than involving individual competition.[2] This is partly to encourage students to learn to communicate their analytical ideas, to collaborate effectively, and to provide mutual support and social interaction. It also offers some organisational advantages in terms of registration and marking. Because team members may have different levels of ability, the competition process does not necessarily identify the highest achieving individuals, but this risk is outweighed by the benefits to the students of working in teams.[3] The organisation of the first round into separate regionally-based competitions means that each team competes in a smaller pool initially with a better prospect of attaining a distinct level of local achievement. However, since there are considerable differences in the number of teams in each region and the top teams from each region are invited into the national round, the national competition does not necessarily consist of the highest achieving teams nationally and there is currently discussion of methods to minimise this effect. Finally, the results are structured to recognise participation as well as high achievement: in addition to recognising the top teams, all teams receive certificates in the categories gold (top ≈25%), silver (next ≈25%) and bronze (remainder).[4]

4. *Organising the Annual Competition*

4.1. UNIVERSITY LEVEL

All Australian states and territories (with the exception of Tasmania) now participate in OzCLO and there is typically one Local Organising Committee (LOC) for each geographical region. There are currently eight LOCs. Each LOC has the responsibility for student and school liaison, university space booking, recruiting volunteer academic and student helpers, running the competitions, publicising the event locally and finding cash or in-kind sponsorship (e.g. for rooms, venues, printing and prizes).

The National Steering Committee (NSC) is comprised of the Chair of each LOC, the Problems Coordinator, the Treasurer, the OzCLO Webmaster and the Online Competition Coordinator. The NSC's role is to coordinate between LOCs, make and implement OzCLO decisions, and coordinate national sponsorships and publicity. A range of training materials is developed by the NSC and provided online each year (as discussed in Section 6), on the OzCLO website and within the online competition site. The training materials are uploaded on the OzCLO website at no cost. Individual universities provide space and materials, and as such sponsor the on-campus sessions. Some universities pay for an administration assistant to help with OzCLO tasks in that state (e.g. Victoria and Queensland), and sponsorship from the Australian Linguistic Society has allowed for additional training to be provided to the national winners in preparation for the IOL. On occasion, some schools which have not been able to attend the on-campus training session have requested an in-school (offline) session, and this has been delivered by academic or research student volunteers, at their own expense, but with materials sponsored by the participating university.

The NSC Chair has the responsibility of ensuring the coordination and execution of tasks for OzCLO, both nationally and internationally. The NSC Chair and the Problems Coordinator liaise with ELCLO (English Language Computational Linguistics Olympiads) with regard to developing annual problem sets and with the International Linguistics Olympiad (IOL) with regard to the international competition. Because of the distances between regional centres, the NSC meetings are all conducted via teleconferences, with regular contact and distribution of documents achieved through electronic means (primarily a mailing list).

4.2. SCHOOL LEVEL

OzCLO operates on a democratic basis, with the devolution of decision-making passing from NSC to LOC to school teacher to students. Teacher and student feedback often contributes to NSC discussions. Information is disseminated to school teachers through the website as well as through emails from the regional LOC. This information is also shared via Facebook and Twitter accounts. Training sessions are provided online, at universities and, in some cases, within schools (as described in Section 6). Teachers register teams of four members at the junior (years 9 and 10) or senior level (years 11 and 12) online. There is no limit to registrations for the online competition, but registrations for the offline competition (in which students typically attend the organising university campus) may be constrained by university venue availability issues. Some schools have Linguistics Clubs, and OzCLO is a strong focus for their activities. In some regions, schools with over 80 participating students request in-house training and invigilation for an offline first round.

4.3. THE PUBLIC FACE OF OzCLO

OzCLO has a website (www.ozclo.org.au) and a social media presence with Twitter and Facebook accounts for communications and promotion. Most LOCs have been successful in

gaining publicity for OzCLO through their university media departments. Many schools publish pictures and items about OzCLO achievements in their school newsletters. Some individual schools have featured in the local press after results of competitions have been published. OzCLO has also featured in national radio segments. Links to all relevant media segments are provided on the OzCLO website.

5. *Problem Sets*

In its first two years, OzCLO greatly benefited from NACLO, which allowed use of their problem sets. Some additional problems were composed by linguists engaged in the running of the competition or their colleagues. Since 2009, OzCLO has been part of ELCLO, the English Language Computational Linguistics Olympiad, in which participating countries (Australia, Ireland, North America and the UK) contribute to a shared set of problems. The Problems Coordinator on the OzCLO Steering Committee solicits suitable problems from the Australia-based community of linguists and forwards them to the ELCLO pool. She liaises with the other ELCLO competition coordinators in the selection of common problems for each year's competitions. Over 100 of the problems used in ELCLO competitions since 2007, plus solutions, have been compiled by Dragomir Radev to serve as a competition training manual, as well as for anyone seeking a linguistic problem-solving challenge (Radev 2013).

Because of the OzCLO rationale described in Section 2 above, an attempt is made to try to have a mix of problems based on data from a wide range of languages and also a wide range of data types. Different levels of difficulty are included so that students have the satisfaction of being able to solve most of the problems, with the more difficult problems challenging the strongest teams. The aim is to show students that analysing language phenomena can be fun as well as challenging and also that linguistic skills can be applied to some very practical tasks. The problems include the following: deciphering non-Roman scripts including hieroglyphs and braille; translation tasks of individual words, phrases or whole sentences from an unknown language into English and back involving typical morphological and syntactic analysis; computational linguistic tasks, for example, using rules to generate strings; searching for phonological rules with the extra challenge of diacritics and special characters for English speakers; semantic analysis of complex inflectional morphology, e.g., tense, aspect and voice contrast, or linguistic reconstruction. (See Supporting information A–F for a sample of problems from past competitions.) We also try to include at least one task requiring students to engage with data from an Australian language; since 2008 these have included Arrernte, Bardi, Dyirbal, Pitjantjatjara, Waanyi, Warlpiri and Wembawemba. Once all national competitions are complete, the problem sets used in both the first round and the national round (with solutions) are posted on the OzCLO website (http://www.ozclo.org.au/other/past-problems/). This website also has links to the other ELCLO past competitions. Thus competitors can compare the posted solutions with their own. At the same time these postings allow prospective competitors the opportunity to test their skills and to prepare for the upcoming competition round, all the while learning more about languages and linguistics.

Cracking the code of an unknown language presents a huge intellectual challenge. Moreover, it involves testing each student's capacity for logic, deduction and problem solving, as well as lateral thinking. Knowledge of foreign languages is not required, but some linguistic intuition about word order, case, tense, animate/inanimate nouns and gender is useful for solving a range of analytical problems in real but unfamiliar languages in the form of complex puzzles. Students with some knowledge about grammar are naturally at an advantage, and so an attempt to teach students some grammatical awareness is incorporated into the training provided (see Section 6).

To begin with, the process involves 'breaking down the problem' by exploring the grammars, sounds and writing systems of the language puzzles in search of small and large-scale patterns of regularities. The hypotheses arising from the previous step can now be linked to a set of phonological, morphological or syntactic rules, or constraints on these rules, and tested. The final step involves using logic to relate the linguistic discoveries to meaning, by analogising. Solutions increase in complexity from simple correct answers to clear and correct formulation of underlying rules. We have designed the layout of some problem sets so that it will guide the competitors through the steps needed to analyse the language data. This is exemplified in the 'Being Beja' problem set in Supporting information E.

In order to make problems solvable and more of a fun exercise, irregularities and exceptions to rules should ideally be kept to a minimum. However, striking the perfect balance between fun and challenge, a key principle of OzCLO, is not an easy task. Perfect scores do not abound and parts of the problems are often left unanswered or incorrectly solved, especially given the pressure of having to complete the task within two hours. Typical mistakes include oversight or misjudgement of patterns, misgrouping of elements, and failure to work out the underlying patterns of form-function relations such as case, tense, word order or specific features of nominal phrases such as animacy/inanimacy, gender and number.

Until 2012 all papers were marked by hand, aided by a marking guide for nationwide consistency. With more participants opting for the online alternative, which was introduced in 2012 for the regional first round, the marking burden for volunteer academic staff and helpers has been greatly reduced. The marking of the final national round is a task shared by all LOCs, with each LOC marking one problem nationally to ensure consistency.

6. Training

6.1. TRAINING FOR OzCLO

A variety of offline and online materials is provided as training for the first round in order to initiate prospective students into the kinds of problems they can expect to solve in the competition. An initial training pack is made available to schools on the OzCLO website and via email mail-outs to teacher contacts. For new teams, this training package may be the first opportunity students have to engage with language problems and to begin investigating and exploring data and patterns in a variety of different languages, using a range of analytic processes. The pack first provides a simple morphological analysis, suitable to do as a whole-class exercise even if the students do not proceed to the competition itself, and also includes a range of sample problems, which are worked through step-by-step. Some input is given about linguistic principles and key ideas that will assist in solving each training problem and can be extrapolated to other problems in the competition. Teachers can also use these materials in the classroom and create a positive experience of linguistics, even for students who are not involved in OzCLO.

Once schools have registered for the first round they gain access to a broader range of training materials via the competition website (see Section 8). Teachers may consult documents, PowerPoint slides and audio presentations that give information about linguistics as a discipline, key grammatical concepts, as well as typical OzCLO problem types. Step-by-step instructions are provided on how to solve problems from a range of languages using the linguistic method of mining data for patterns, drawing hypotheses and testing those hypotheses to arrive at a solution to the problem. The competition website also contains links to a number of practice problem sets and training PowerPoint slides available on the websites of international Linguistics Olympiads: for example, the International Linguistics Olympiad (IOL); the North American Computational and Linguistics Olympiad (NACLO); and the United Kingdom Computational

and Linguistics Olympiads (UKCLO). Some states and territories also offer on–campus training sessions provided by academics and interested research students at the participating university using the available training materials. All students work on a common set of problems, and sessions involve explanations of core linguistic areas (phonetics/phonology, morphology, syntax and semantics). Students are introduced to linguists who talk a little about their own research and provide training and practice on identifying linguistic features in unknown data, and on using the linguistic method to solve linguistics problems. Volunteers at the different universities may add problems in other languages or provide additional materials, but these are always shared with organisers in other states and territories through the OzCLO cloud (see Section 9).

6.2. TRAINING FOR THE IOL

Since 2009, an Australian team has participated in every IOL. While the main goal of OzCLO has always been the promotion of language studies, linguistic knowledge and analytical skills in Australian high schools, the appeal of potentially participating in an international competition has proved an additional incentive for many of the students and their teachers. However, because of the rationale for OzCLO discussed in Section 2 above, the problems used in the first round and even the national round are not nearly as difficult as the actual IOL problems. Therefore the Australian team needs to be given additional training before competing at the international level. This training was first provided by a coach accompanying the team at the IOL, but we have found that this was insufficient and too late to be helpful. We now provide training sessions aimed at solving IOL–level problems to the winning team prior to travelling to the IOL, usually run by linguistics PhD students at the local participating university. This has resulted in improved performances at the IOL, including an individual silver medal in 2011, an individual bronze medal in 2013, and honourable mentions in 2010 and 2012.

7. Participation 2008–2013

OzCLO has evolved from 22 schools and 119 competing students in 2008 to 87 schools and 1451 competing students in 2013. Some schools have participated each year, and there has been a steady increase in new schools. Private schools and selective government schools have so far been the majority in most regions, but the numbers of government schools participating are growing. All participating schools are highly enthusiastic about the OzCLO competitions.

OzCLO naturally attracts schools keen on offering a new kind of challenge to students in their GATS (Gifted And Talented Students) programmes. However, teachers (not only language teachers but also mathematics and computer sciences teachers) also comment that OzCLO is a rare kind of competition because it provides fun, challenge, stimulation and team-work for any student and crosses the maths/science – humanities divide.

A challenge for Australia compared with Europe or North America is the enormous distance between rural and metropolitan areas, making it difficult for many schools in rural areas to participate in a university-based competition. The advent of the online option (see Section 8) gives urban, rural and country remote students equity in access. Thanks to this, plus a strong marketing drive throughout the state, numbers have increased dramatically in Queensland. In other regions, some schools prefer the university campus experience offered by the offline option.

As Table 1 shows, numbers have increased steadily over the 6 years since inception. In 2013, Australia's population of 23 million provided nearly as many Linguistics Olympiad competitors as have the United States and Canada combined, whose population figures are 15 times more than Australia's. The OzCLO participation rate is 6.4 per 100 000 population. For UKLO it is 4.55, and for NACLO 0.49.

Table 1. Participation schools/students.

LOC	2008 Schools/ students	2009 Schools/ Students	2010 Schools/ students	2011 Schools/ students	2012 Schools/ students	2013 Schools/ students	Region population 000s	Participants per 100,000 population
NSW-S	10	14	[fn/a]	15	12	9	7314	5.24
	64	105	92	279	289	312		
NSW-N	n/a	n/a	5	7	5	6		
			40	58	60	71		
VIC	12	11	[fn/a]	9	16	18	5649	5.38
	55	90	120	115	245	304		
ACT	n/a	7	5	5	9	9	377	42.76
		30	83	72	136	161		
QLD	n/a	11	15	15	20	25	4585	8.22
		60	90	106	312	377		
SA	n/a	[fn/a]	5	3	4	3	1658	2.05
		29	33	19	27	34		
NT	n/a	n/a	n/a	n/a	n/a	6	236	33.86
						80		
WA	n/a	10	11	16	14	12	2451	4.90
		78	144	143	120	120		
TAS	n/a	n/a	n/a	n/a	n/a	n/a	512	0
Overall	119 students	392 students	602 students	792 students	1069 students	1459 students	22 786	6.40

n/a, not applicable (LOC was not participating); [fn/a], figure not available.

8. *Going online*

In the first four years of OzCLO's existence, the competition was offered on campus by academic staff volunteers from a number of mainly metropolitan universities. Participating teams travelled from their schools to the respective universities' campuses to take part in the training session and the first round, except for NSW, where several OzCLO representatives also travelled to schools with a large participation base, in order to run the competition at the school. Teachers often reported that these visits to the university campus were a highlight for the participating students who very much enjoyed the experience.

Nonetheless, a number of drawbacks to this approach became apparent quite early. These include the following:

• The difficulty of organising suitable venues on campus for running the competition due to the timing of the first round (usually coinciding with universities' orientation week or their first weeks of teaching in the first semester).
• The distance factor with the result that only schools within easy travel distance could participate in the competition (in the case of Queensland, for instance, no school beyond a distance of about 100 km from campus participated in the offline competition). Given the size of Australia and the limited number of regional universities, most regional and rural schools were thus virtually excluded from competing.
• Constraints on availability of venues and markers put a cap on the overall number of students who could compete in each region. Thus, the number of schools and the number of students per school had to be limited by the local committees from the outset (e.g. in Queensland, only two teams per school were allowed to compete, although some schools wished to enrol many more).

In order to address these issues, it was decided to offer an online option in 2012, using Griffith University's Learning Management System. This lifted restrictions on numbers (both schools and students per school), and schools were able to compete from anywhere in Australia if they so wished. As a result, schools located as far as 1500 km from the metropolitan areas have successfully participated in the competition, and some schools registered more than 20 teams in the latest competition. With the online option, the overall number of participants has increased dramatically (see Table 2). For instance, Victoria saw the number of their participants double from 2011 to 2012, while numbers in Queensland nearly tripled. Even in those regions that shifted to exclusively offering the online option (such as Queensland in the last two years), most schools have remained in the competition.

In terms of students competing online versus on-campus (offline), except for the NSW-N region, there is a distinct shift towards participating online. Feedback from teachers has shown that in many cases it is easier for teams to stay within the school grounds for the competition rather than to travel to the university campus. For some schools, however, travelling to the university campus is still one of the major benefits they would not want to lose. For this reason some LOCs offer both on-campus and online options. Also, some regions that choose to only offer the online option still run a training session at the university.

Teams participating online have access to training materials and all the necessary information, which is made available through the OzCLO competition website well before the competition day. This website also allows teams to familiarise themselves with the online testing system. All teams across Australia compete on the same day and within the same two-hour period (to compensate for time zone differences, in the 2013 competition teams started at 12:00 in WA, 13:30 in the NT, 14:00 in QLD, 14:30 in SA and 15:00 in the ACT, NSW and VIC).

In terms of process and technical requirements, each participating team needs access to an Internet-enabled computer on the day of the competition. Only a standard Web browser and PDF viewer are required on the school's computers. The set of problems is made available to teachers shortly before the competition commences, in order to allow them to print and copy the problems for the students. Students usually work on the paper copy and then access the computer to enter their responses. There is also a virtual classroom set up for live communication during the competition, in order to allow students and teachers to ask questions but also to show students that there are hundreds of competitors participating from around the country at the same time.

Table 2. Participation numbers by mode (online/on-campus (offline)).

LOC	2012		2013	
	Online students	On-campus students	Online Students	On-campus Students
NSW-S	91	198	120	192
NSW-N	60	[on/a]	8	63
VIC	137	108	195	109
ACT	64	72	115	46
QLD	312	[on/a]	377	[on/a]
SA	0	27	34	[on/a]
WA	28	92	120	[on/a]
NT	n/a	n/a	80	[on/a]

n/a, not applicable (LOC was not participating); [fn/a], figure not available; [on/a], option not available.

Overall, the addition of the online alternative has been a very beneficial development for OzCLO. The strong growth in overall participant numbers over recent years is not only due to the online option, but this has certainly played a major role. It remains to be seen if there is even more potential for growth – especially in areas outside of the major cities.

9. *Challenges*

One of the main challenges OzCLO faces is the timing of the competition in relation to the schedule of the international linguistics competitions. The Australian school year begins in February and ends in December, and the university year is roughly March to November, in contrast to the September–June academic calendars of the northern hemisphere. In order for an Australian team to be selected with enough time to prepare for participation in the IOL (usually held in July), the national round needs to be held before the Easter break (March/April). For universities and schools, this creates a very rushed timeline at the busiest time of the school/ academic year.

As mentioned earlier, another challenge for Australia is the vast distances between metropolitan areas, where most of the universities are located. In spite of the success of the online competition, so far OzCLO has mostly had a metropolitan base and has not yet fully engaged in marketing to regional and rural areas across the whole country. Targeting appropriate teachers within schools can also be a challenge, as experience has shown that often the information does not filter through the relevant teachers (these are usually the coordinators of Languages, Gifted Education, Mathematics or Computing programmes). Contacting the professional associations for the different teaching specialties could ensure that information is disseminated more efficiently. Beyond targeting appropriate teachers is the challenge to keep them motivated and interested in competing each year amid the other pressures at the start of the school year. At some future point it might be useful to develop some teacher-oriented support tools for training OzCLO students.

Funding is not guaranteed, and fundraising efforts are not rewarded every year. All organisational efforts at university and school level depend on goodwill and volunteering as well as donations. Changes in heads of departments in universities and principals in schools can impact negatively on funds and participation levels. This means that core issues need to be resolved again every year, for example, the ongoing maintenance of the OzCLO website/online registration system, which is both a challenge and a solution to other issues. The OzCLO website hosting is provided by Macquarie University, and the site is maintained by a student volunteer. It has served as the central hub of information, with other modes (email, Facebook and Twitter) leading back to it for detailed information. In addition to ordinary information, the OzCLO website hosts an increasing number of services, including self-service registration, automated generation of PDF certificates (after the competition) and, most recently, *ownCloud* (ownCloud.org), an open-source central cloud storage system. These facilities and the volunteer support of the webmaster have significantly lowered the administrative and financial overhead for the organisers.

An additional problem for OzCLO is the division of Australia's most populated state (NSW, with almost a third of Australia's population) into northern and southern regions, which leads to one state providing double the competitors of other states into the national round. A model is needed whereby all competitors, no matter whether they come from a small or a large region, have an equal opportunity to compete in the national round.

Finally, an ongoing challenge lies in engaging the broader linguistics and computational linguistics community to help with the development and testing of problems to contribute to the ELCLO pool (Estival 2011). Not surprisingly, several of the past OzCLO national team

winners have gone on to study linguistics and computational linguistics further at university. In late 2013, Steering Committee members contacted some past national winners to determine their willingness to help in the development and testing of new problems. While they require substantial support and direction in this endeavour, it suggests a promising approach to expanding our national contribution to the ELCLO pool.

10. Conclusions

In conclusion, running the OzCLO competition has been an activity well worth the effort, and it is very rewarding that it has become a fixture in the academic calendar for many schools. Students, teachers and principals have been extremely positive about the experience, giving encouraging feedback and expressing strong support for the competition. The recent increases in participation rates have come from new regions (only one Australian state currently has no LOC, but possibilities are being explored in this area), new schools and larger numbers from individual schools (up to 100 participants from a single school). Some schools have started a Linguistics Club as an after-school activity, and others are promoting their experiences on social media.

   OzCLO has now been running in most regions long enough to see participants reaching university, and although there has as yet been no research on the impact of OzCLO on enrolments in linguistic courses at university level, increased interest in and awareness of linguistics is certainly a positive outcome for a discipline which faces challenges of funding and viability. Furthermore, there is anecdotal evidence from former participants that they have chosen to study some linguistics at university as a result of their participation in the competition. A number of spontaneous testimonies from students and parents have been forwarded to various local organising committees highlighting the direct connection between participation in the OzCLO competition and their current university studies with Linguistics as a major area of their degree. For example, a student in Western Australia wrote to her former high school teacher:

> I also just want to thank you for introducing me to OzCLO in year 10/11/12 because that was the reason that I became interested in doing some linguistics units at university, which I am loving so far!!

   Other such testimonies have been provided in other regions, including Victoria, Queensland and the ACT where school students' interest is often sparked by contact with university linguistics lecturers as well as language teachers who have spoken favourably of OzCLO. It is therefore possible that OzCLO, and the greater awareness of languages and linguistics that it has generated amongst the high school population, is a contributing factor in the increase in student numbers in many linguistics courses around Australian universities. Enrolments in the first year linguistics course at the University of Melbourne, for example, have grown steadily from 150 in 2008 to 225 in 2013, a 50% increase in the five years since OzCLO began – although it is certainly not the only contributing factor. A similar 50% increase in student enrolments within the last five years has also been recorded in first year linguistics courses at Flinders University in South Australia. As each year we see steady growth in linguistics courses, we have started to collect evidence of former OzCLO participants going on to study linguistics in universities, and we intend to conduct appropriate surveys in linguistics and computational courses in the near future to identify students who have participated in OzCLO.

   The cooperation of academics from universities across the country in all the LOCs and the NSC, plus the support of the Australian Linguistics Society (ALS) and the Australasian Language Technology Association (ALTA), makes the competition a truly national event. This means that the competition is not dependent on any one single person or institution (although competition

within particular regions is) and allows for further growth. Securing ongoing funding and support from both universities and schools across the country should see continued growth in the popularity and spread of the competition.

Notes

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Additional supporting information may be found in the online version of this article at the publisher's web-site.

[1] An earlier and shorter version of this paper was presented in the workshop on 'Teaching NLP/CL with a Focus on Olympiads in (Computational) Linguistics' at the Association for Computational Linguistics conference, 8 August 2013, Sofia, Bulgaria (Estival et al 2013).

[2] This is one respect in which OzCLO differs from many other Linguistic Olympiads, including the IOL, which have both team-based and individual-based elements to the competition.

[3] The team-based nature of the competition is frequently mentioned by participants as one of the highlights, as in the video interview with the winning Junior Queensland team (2013) available here: http://www.youtube.com/watch?v=SIurligfDM8.

[4] A reviewer notes that this may be 'overgenerous' since all participating teams are awarded either gold, silver or bronze. However, since our primary goal in the first round is to introduce high school students to linguistics and stimulate their interest in the discipline (see Section 2), we prefer to encourage them at this stage and see nothing to be gained by identifying the worst-performing teams.

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