

Final report: *Language Technology* as an area of strength at the University of Gothenburg

31 mars 2016

1 Achievements during the period of area-of-strength funding

The direction and content of the CLT (Centre for Language Technology <<http://www.clt.gu.se>>) collaboration enabled by the area-of-strength funding to language technology (LT) were originally set out in a strategic plan submitted in June 2009. The plan outlines the broad areas of research for CLT, and also describes more concretely which measurable results we expect to show at various times during the period of financing. On the whole, the activities and results have been the ones foreseen in the strategic plan. All the success indicators listed in the strategic plan are present. Out of the five development areas outlined in the plan, **wide-coverage systems** and **linguistic resources and tools** have been present throughout the funding period, and considerable progress has been made in these areas. In the areas of **semantics** and **expansion beyond LT**, a good deal of progress can be seen, particularly with regard to **lexical semantics**, a field where we have also seen some progress in the fifth development area is **machine learning**, with a new growing group and seminar series in collaboration between the Dialogue and Grammar Labs. The expansion beyond LT will be further elaborated below.

Speaking in more general terms, because of the CLT funding, language technology in Gothenburg has become visible in a completely different way from earlier. This is of course due to the confluence of a number of factors. We cannot deny that LT was strong in Gothenburg before the CLT funding was granted – indeed, this was what originally made LT a potential area of strength – but the funding has allowed us to focus on (1) synergistic integration and growth at the University of Gothenburg; (2) local, national and international networking; and (3) visibility in many more contexts, in a way that would have been very difficult or impossible without this funding. Below we elaborate on these three points.

1.1 Integration and growth at GU

Large project grants The area-of-strength funding has made possible work on successful applications for external funding, resulting in several large project grants. In total we attracted nearly 300 MSEK. Some of the project grants have included new cross-disciplinary collaborations, concrete examples being, e.g., the *MOL-TO* EU project, the *Knowledge-based culturomics* VR framework grant, *CLASP*, a Swedish Foundation for Humanities and Social Sciences *New vistas for HS* grant, and participation in one of the funded *UGOT Challenges* centers. CLT has turned out to be a very effective platform for applying for project money and for coming up with new projects and new collaborations.

Research collaborations All the involved groups have grown and diversified over the CLT funding period, forming research collaborations with new individuals and groups in their respective departments, and in several instances beyond the CLT departments. A case in point is the very fruitful collaboration between the CLT Grammar Lab, the CLT Text Lab, and the DART unit in the Sahlgrenska University Hospital on building LT-based assistive communication technological applications and on integrating Blissymbols with concepts in modern Swedish lexicons. We have also seen some mobility among the participating departments.

Recruitment of researchers The money allocated to CLT junior researchers has in some instances resulted in new postdocs and permanent positions in participating departments. As a result some of the recruited researchers have been very successful in attracting external funding and in attracting new prominent leaders to Gothenburg, *CLASP* being one example.

Large-scale electronic resources and infrastructure Having CLT funding for hiring system developers/research engineers has meant a lot for our work, in particular in the CLT Dialogue Lab, where there earlier were no dedicated people available to work on implementations and infrastructure development and maintenance. In the CLT Text Lab the additional system developers have facilitated a long-term concentrated development effort resulting in infrastructure investments including the high-profile corpus infrastructure *Korp*, the corpus annotation infrastructure *Koala* and the *Swe-Clarin* infrastructure. *Korp* is an open-source infrastructure which is now being used by centers in Finland, Norway, Denmark, and Estonia. *Koala* is an infrastructure for text-based research with high-quality annotations. *Swe-Clarin* is the Swedish node of the European infrastructure *CLARIN ERIC*, the Common Language Resources and Technology Infrastructure, where the purpose is to make language-based materials available as primary research data for humanities and social sciences. *Swe-Clarin* is coordinated by *Språkbanken/Dept. of Swedish*, the host department of CLT.

In the CLT Grammar Lab, the research engineer positions have been devoted to developing the Grammatical Framework infrastructure, another CLT “success sto-

ry”. This multilingual framework has support for over 30 languages and today is being used worldwide by researchers in academia and industry. Research engineer positions have also greatly facilitated the design and implementation of a common infrastructure, resulting in a degree of reuse of resources across CLT that we would probably not have seen without this funding. Concretely this can be seen in large-scale electronic resources such as the lexical resources SALDO, SweFN and SweCcn developed by the Text Lab. These resources are being used as essential components in the wide-coverage Swedish grammar being developed by the Grammar Lab. As evidence for our successful effort in expanding our resources and infrastructures is the fact that Språkbanken is being promoted by the University of Gothenburg as a future national infrastructure. As a first step in this direction, Språkbanken was established as a university infrastructure in 2015.

National interest in our Master Program in Language Technology To a considerable extent, the Master Program in Language Technology (MLT) is made possible by the strong research environment that we have in CLT. Recognizing this, in the BLUE 11 evaluation of study programs conducted in 2011, the evaluators stressed the importance of CLT to the MLT program. The MLT teachers come out of CLT, MLT students are encouraged to attend CLT seminars, and external CLT guests are frequently encouraged to give talks aimed at a student audience in particular MLT courses. Further, MLT students have plenty of opportunities to carry out their master’s projects in an ongoing CLT research project.

1.2 Networking

CLT seminars and workshops The area-of-strength funding has increased our networking opportunities within and outside our group. We have been networking efficiently and successfully with national and international researchers. What made networking possible is our joint CLT seminars taking place every Thursday. These seminars have been the core of our work. Another core is our annual CLT workshop, a two-day meeting held at a conference center away from the university, allowing the CLT members to present and share their research ideas with each other as well as to discuss new collaboration possibilities, without external distracting factors.

International workshops and summer schools An important part of the successful and increased cooperation has been because of our annual international workshops and bi-annual GF summer schools. Språkbanken’s workshops have been taking place in Gothenburg each autumn since 2011, each workshop with a special theme. The GF summer schools have been taking place in different venues every second year since 2009. These summer schools attracted many new developers and users that still today are using GF actively.

Guest researchers In the absence of the present directed funding to CLT, most of

our extensive networking activities would not have come about. This concerns primarily guest researchers. Thanks to the CLT funding, several CLT seminars every semester have been presented by a steady succession of guest professors and researchers, who have also met with CLT researchers individually or in groups. These guests have also enhanced our international visibility.

Dynamic interaction The money available for inviting national and international guests (for CLT seminar talks and longer stays) has been extremely valuable and productive, and has in some cases led to concrete research collaborations, and to increased CLT participation in Nordic and European research contexts.

Collaborations with industry and other disciplines CLT researchers have collaborated with companies in the vehicle industry, for example in the SIMSI project the group at the Dialogue Lab collaborated with Mecel AB. There are also a number of established and nascent GU-internal collaboration initiatives e.g., with literary scholars (on Digital Humanities), with political scientists, with researchers in health science, medicine, and physics.

European collaboration Another networking initiative takes place within the large European infrastructure project CLARIN, where we have already begun to strengthen relations between the nine Swe-Clarín national consortium members as well as with international nodes participating in CLARIN ERIC.

1.3 Visibility

EACL and Vetenskapsfestivalen 2014 CLT managed to win the bid for and very successfully organize the 14th conference of the European Chapter of the Association for Computational Linguistics (EACL 2014). With over 500 participants the Gothenburg conference became a record-breaker among the EACL conferences. CLT also put in a massive effort at *Vetenskapsfestivalen* in Gothenburg 2014.

Commercialization At least three companies started by CLT researchers can be mentioned here: Digital Grammars AB, Access and Language Technology, and Talkamatic.

New collaborations within GU CLT researchers were contacted as potential collaborators on UGOT Challenges proposals from other parts of GU, without any previous history of collaboration, which should be taken as an indication that LT has become more visible inside the university.

Acknowledgment within the departments Language technology has become part of the individual departments. CLT (or rather CLT-related research) has made LT visible at e.g. the CSE department, and the same goes for the Swedish department where e.g., LT courses are now being introduced in the undergraduate and advanced level curricula in Swedish.

Nordic and European expansion We have become more visible in the Nordic countries and Europe. Language resources and tools such as Korp, TrindKit and GF have become central for other universities such as Helsinki and Edinburgh. GF has had an increased amount of external users including companies.

Role model for other institutes Some of our external contacts and collaborators have used CLT as a success-story role model for proposing similar initiatives in their home institutions e.g., Riga, Tromsø.

2 Prospects for the future

The most fundamental added value of the CLT funding – and at the same time that which will be most difficult to cover from alternative sources – is the combination of increased integration brought about by the annual CLT workshops and the regular CLT seminars, and the networking possibilities offered through the impressive number of invited external guests afforded by this funding, as well as by the travel money available to CLT researchers for going to conferences and other relevant events outside Gothenburg. It should be noted that these activities are mutually reinforcing. Going to conferences and other events is a good way of coming into contact with interesting individuals who can be invited to Gothenburg for giving a talk at a CLT seminar or the CLT workshop, and for meeting CLT researchers for consultation and brainstorming meetings. At the same time, the many external guests at CLT events make the events more attractive to the CLT members and other students at the departments. In fact, attendance has been consistently high both at the seminars and the annual workshops.

We would very much like to be able to continue these activities, but this typically requires another kind of funding than normal project funding or regular research funding from our departments and faculties. Especially the latter is normally earmarked for salaries and does not as a rule include even conference travel, etc. We have been discussing our alternatives and decided to apply for minimal funding from our faculty, also for supporting some website administration.

The CLT funding has allowed us to focus on infrastructure development to an extent which has not been possible earlier. We are now investigating how these activities could be continued or even strengthened, since the need to maintain and develop a bespoke research infrastructure is increasing, not decreasing. In part, this is a discussion conducted with the Faculty of Arts and the university level in the context of the university undertaking a major revision of its policies regarding funding and organization of research infrastructures. GU is the coordinating partner of the VR-funded Swedish CLARIN ERIC node (Swe-Clarín <<http://sweclarin.se>>), which gives Språkbanken (and the CLT Text Lab) some additional funding for LT infrastructure development and maintenance. Swe-Clarín will mean a concrete opportunity to develop the e-science strand of the CLT activities further, and in

particular to strengthen the ties between LT and Humanities and Social-Science research. Specifically, we expect to make a significant contribution to the Digital Humanities effort now being initiated at the Faculty of Arts.

As mentioned above, we have increasingly seen collaborative efforts inside CLT, e.g., the ongoing *Knowledge-based culturomics* VR framework project, which involves Swedish/Språkbanken, Computer Science and Lund University, the finished *MOLTO* EU project (Computer Science and Swedish/Språkbanken, plus a number of European partners), the work on LT infrastructure and linguistic resources involving Swedish/Språkbanken, Computer Science and the Dialogue group at FLoV, as well as several (so far) unsuccessful collaborative project proposals submitted to external funding agencies. The majority of these initiatives have also included groups external to CLT, both inside GU and outside it. In many cases these represent connections which most likely would not have been made without CLT, and we see a great potential for initiating more such collaborations in the future if CLT activities can continue in some form.

CLT is much stronger and is more known and appreciated today than it was prior to the area-of-strength funding period. It has grown to become a successful and collaborative research centre. Today it is easier for us to establish new collaborations, both inside and outside GU. National and international visibility has meant a lot for us. For this reason we are planning to continue some of the CLT activities, in particular our weekly seminars and annual workshops for CLT members. These will be sponsored by different ongoing research projects at least at the three departments Computer Science, FLoV and Swedish.

Following our plans for strengthening the area of LT, we created several permanent posts for research engineers but the CLT money has been the main source of funding for only a few of these posts. Most of the money went to junior and visiting researchers. Some of our junior researchers were very successful in attracting external funding, and they are now recruiting new PhD students and post-docs. They allow us to continue our activities in developing new LT methods and tools as well as establishing new collaborations with other universities. We also plan to keep on developing, maintaining and harmonizing our resources with other data and annotation tools.

As the vice chancellor's international advisory board pointed out in their final evaluation report of the areas of strength much of the future success of our group depends on the maintenance and development of our infrastructure. There are ongoing collaboration efforts within Swe-Clarín to increase our infrastructure according to different researcher's needs. Swe-Clarín already covers some use cases that are essential for building our future national infrastructure. For example, we started integrating historical data, and speech into our infrastructure in collaboration with KTH. Adding written dialogue into the infrastructure is also one of our plans.

Språkbanken has achieved the status of "university infrastructure" and is being

promoted by the University of Gothenburg as a future national infrastructure. It has been given extra funding of 3.5 MSEK over two years from the university and the faculty to prepare an application to the Swedish Research Council for national research infrastructure funding.

Regarding the future of the networking activities – internal and external – afforded by the CLT funding, we see these as an important prerequisite for most of the achievements of CLT. It is agreed that the involved departments will contribute to these activities from their faculty funding.

Similar to other universities in Sweden such as Uppsala, and also to other Nordic countries, we experienced a decrease in the number of local students applying for the MA course in LT. On the other hand, the majority of applicants for the MLT program now come from outside Sweden and even from outside Europe. We are positive to strengthening further the already close relationship between our research and teaching. The CLASP activities and new recruitment of PhD students and postdocs are expected to increase interest in LT in general and the MLT program in particular. The program is also being strengthened by combining it with courses from a new interdisciplinary master's program at the department of Computer Science and Engineering starting in 2017 and led by professor Graham Kemp.

3 Budget

CLT has had several important components: administration, junior researches, research engineering, research support, money to invite distinguished researchers, and organizing annual workshops. Our funding was well spent on technical infrastructure and research engineers. We have created a collaborative atmosphere, seminars and workshops and we were able to attract much more funding during these six years.

CLT has had a interdisciplinary nature from the start. During its years as an area of strength, interdisciplinary research collaborations have grown considerably.

There have been constant initiatives for engaging commercial and academic partners. Partners have been continuously invited to take part in our activities at the weekly CLT seminars, national and international workshops. An important outcome of this initiative (and for us, an important aspect of transformation) has been in the founding of spin-off companies.

There are several new important partnerships developing as the result of this creative and collaborative research centre, just to name a few: (1) research in the area of digital humanities involving researchers from the department of Literature, History of Ideas, and Religion; (2) research on linguistic indicators of cognitive impairment in collaboration with neurologists at Sahlgrenska University Hospital; (3) research on combining psycholinguistics and corpus linguistics for comparing

first and second/foreign language acquisition together with the Institute of Swedish as a Second Language.

On the whole, we feel that the area-of-strength funding has been spent in a good way. Much thought and discussion went into the formulation of the original budget structure as submitted in the development plan for the area of strength in 2009, and we have not with hindsight uncovered any major deficiencies in our original reasoning.

We did underestimate the time it would initially take us to appoint the junior researchers and research engineers whose salaries make up the major part of the overall budget. This resulted in the accumulation of some unspent funding in the beginning of the first funding period. This money was partly reallocated into support for “small CLT projects” which CLT members could apply for (as has been reported in an earlier evaluation round). Since most of the awarded project funding went to junior researchers, the money was in fact largely spent on the intended purpose.

Metrics

(i) Publications

See appendix B.

(ii) Grants

- **Digital areal linguistics*. Lars Borin (with Uppsala University and Max Planck Institute for Evolutionary Anthropology, Leipzig). Funded by Vetenskapsrådet, 2010–2012. **2835 kSEK**
- **Functional somatic syndrome – Contextualisation of functional symptoms in primary health care*. Dimitrios Kokkinakis. Funded by Swedish government strategic research (Research Council, VINNOVA, Formas, FAS) within GPCC. **1000 kSEK** for year one, 2011-03-01–2012-02-28.
- *KELLY*. Sofie Johansson Kokkinakis, Lars Borin. Funded by EU, 2009–2011. **36 kEUR**
- **Lekbot*. Peter Ljunglöf. Funded by Vinnova 2010–2011. 1500 kSEK total (**500 kSEK** UGOT).
- *META-NORD*. Lars Borin. Funded by EU, 2011–2013. **254 kEUR**
- *MOLTO*. Aarne Ranta. Funded by EU: FP7-ICT-247914, 2010–2013. 2975 kEUR (**1000 kEUR** UGOT)
- **Pediatric diabetes*. Staffan Larsson. Funded by Swedish government strategic research (Research Council, VINNOVA, Formas, FAS) within GPCC. **289 kSEK** for the Dialogue Technology Lab year one.
- *SAICD*. Robin Cooper. Funded by Vetenskapsrådet 2010–2012. **2595 kSEK**
- **SIMSI*. Staffan Larsson. Funded by Vinnova 2011–2013. 3540 kSEK total (**1920 kSEK** UGOT) (Cooperation with the vehicle industry (Mecel AB) and Talkamtic AB)
- *Swedish FrameNet++*. Lars Borin (with the Berkeley FrameNet group, ICSI, Berkeley). Funded by Vetenskapsrådet, 2011–2013. **6500 kSEK**
- **Towards a knowledge-based culturomics*. Lars Borin. Funded within VR "Rambidrag: Det digitaliserade samhället – igår, idag, imorgon", 2012–2016. **17216 kSEK**

- *Towards a Swedish eScience infrastructure for the humanities and social sciences*. Lars Borin. Funded by Vetenskapsrådet, 2013. 1500 kSEK (**750 kSEK** University of Gothenburg)
- *Mobile services for communication, interaction and learning*. Alexandra Weilenmann. Funded by Vinnova (Vinnmer fellow, qualification project), 2010–2012. **1808 kSEK**
- **Lekbot: En pratande och lekande robot för barn med funktionshinder*. Talkamatic AB, DART och FLOV. Funded by Post- och Telestyrelsen, utlysning ”Var Dags IT”, 2010–2011. **2000 kSEK**
- **TRIK: En talande och ritande robot för barn med kommunikativa funktionshinder*. Peter Ljunglöf. Funded by Stiftelsen Promobilia and Magn. Bergvalls Stiftelse, 2008–2009 **550 kSEK**
- *GF Summer School 2013*. Funded by Volkswagen Foundation. **50 kEUR**
- *GF Summer School 2015*. Funded by Digital Grammars AB and Maltese Ministry for Finance. **35 kSEK**
- **Language Technology Linked Open Data at Språkbanken*. Lars Borin. Funded by VINNOVA, 2013–2014. **497 kSEK**
- **Ett svenskt konstruktikon (A Constructicon for Swedish)*. Benjamin Lyngfelt. Funded by Riksbankens jubileumsfond, 2013–2015. **7436 kSEK**
- *Generell ram för flerspråkig textanalys*. Krasimir Angelov. Funded by Vetenskapsrådet (Projektbidrag för Unga forskare), 2013–2016. **3500 kSEK**
- **GRASP: Grammatikbaserad språkinlärning för barn med funktionshinder*. Peter Ljunglöf. Funded by Sunnerdahls handikappfond, 2010–2011. **220 kSEK**
- *The DNA of mobile communication*. Alexandra Weilenmann. Funded by Vetenskapsrådet, 2013–2015. **3924 kSEK**
- **REMU: Reliable Multilingual Digital Communication: Methods and Applications*. Aarne Ranta (PI), Gerardo Schneider, Koen Claessen. Funded within VR ”Rambidrag: Det digitaliserade samhället – igår, idag, imorgon”, 2013–2017. **17700 kSEK**
- *MaritimeGF – Applying Language Technology to Improve Maritime Communication*. Ramona Enache. Funded by Innovationskontor Väst, 2013. **150 kSEK**
- *Koala – Korp’s linguistic annotations, developing an infrastructure for text-based research with high-quality annotations*. Yvonne Adesam. Funded by Riksbankens jubileumsfond, 2014–2016. **5605 kSEK**

- *MAPIR – Methods for the automatic analysis of text in digital historical resources*. Gerlof Bouma. Funded by Markus och Amalia Wallenbergs minnesfond, 2014–2016. **3400 kSEK**
- *Distributionella metoder för ramsemantik och konstruktionsgrammatik*. Richard Johansson. Funded by Vetenskapsrådet, 2014–2016. **3760 kSEK**
- **Networks and Types*. Robin Cooper. Funded by Vetenskapsrådet, 2014–2016. **2500 kSEK**
- **SWE-CLARIN*. Lars Borin. Funded by Vetenskapsrådet, 2014–2018. 50 000 kSEK (**25000 kSEK** University of Gothenburg)
- *MUSTE – Multimodal semantic text editing*. Peter Ljunglöf. Funded by Vetenskapsrådet, 2015–2018. **3600 kSEK**
- **Sydasien som språkförbund? Explorativa dataintensiva metoder för areal-lingvistisk och genetisk språkjämförelse*. Lars Borin. Funded by Vetenskapsrådet, 2015–2019. **7335 kSEK**
- *CLASP, Centre for Linguistic Theory and Studies of Probability*. Director: Shalom Lappin. Funded by a VR Grant for international recruitment of leading researchers, 2015–2024. **109000 kSEK**
Applicant: Vice Chancellor Pam Fredman; application prepared by Simon Dobnik, Robin Cooper, Staffan Larsson
- *Flest och fler: Superlativa kvantitetsuttryck i olika språk*. Elizabeth Coppock. Funded by Vetenskapsrådet. 2016–2020, **4600 kSEK**
- *Språkliga och extra-lingvistiska parametrar för tidig upptäckt av kognitiv svikt*. Dimitrios Kokkinakis. Funded by Riksbankens jubileumsfond, 2016–2019. **10460 kSEK**
- *Centre for Ageing and Health – studies on capability in ageing – from genes to society* Ingmar Skoog, UGOT-challenge, GU, 2016–2021. ca 7000 kSEK/år, **35000 kSEK**
- *Den mobila kommunikationens DNA*. Ylva Hård af Segerstad and Alexandra Weilenmann. Funded by the department of Applied IT. 2016, **777 kSEK**

Total approximately **294 MSEK** (including 109 MSEK for the CLASP centre)

(iii) Personnel

(a) Administration

- Lars Borin, Director, 10 %

- Martin Kaså, Project administration officer, 2009–2014, 50 %
- Dana Dannélls, Project administration officer, 2015, 50 %
- Yvonne Adesam, temporary part time, LOC for EACL 2014
- Nina Tahmasebi, temporary 3 months full time, LOC for EACL 2014

(b) Technical support

Department of Applied IT (ITIT)

- Katerina Cerna
- Mattias Rost

Department of Computer Science and Engineering (CSE)

- Thomas Hallgren
- Cenny Davidsson

Department of Philosophy, Linguistics and Theory of Science (FLoV)

- Robert Adesam
- Sebastian Berlin

Department of Swedish (Språkbanken)

- Karin Friberg Heppin
- Annika Kjellandsson
- Svetoslav Marinov
- Leif-Jöran Olsson
- Johan Roxendal
- Anne Schumacher
- Jonatan Uppström

(c) Junior researchers

- Staffan Larsson, researcher at FLoV, funded in part 2010–2012; professor since 2013
- Simon Dobnik, researcher at FLoV, funded in part 2013–2015; previously faculty funded post-doc (CLT funding explicitly behind the employment after the post-doc period); docent since 2015
- Cajsa Ottensjö, researcher at FLoV, funded in part 2012, 2014–2015
- Stina Ericsson, researcher at FLoV, funded in part 2012; lecturer at the Linnaeus University in 2012

- Peter Ljunglöf, assistant professor at CSE, fully funded by CLT 2011–2014, associate professor at CSE from 2015, funded in part by CLT 2015 (CLT funding explicitly behind the creation of this “tenure track” position); docent since 2013
- Dimitrios Kokkinakis, researcher at Språkbanken, funded in part 2009–2015; docent since 2009
- Ylva Hård af Segerstad, researcher and associate professor at Applied IT, funded 2011 and 2015; docent since 2013
- Karin Friberg Heppin, researcher at Språkbanken, funded in part 2010–2015
- Ildikó Pilán, researcher and PhD student at Språkbanken, funded in part 2014
- Nina Tahmasebi, researcher at Språkbanken, funded in part 2014–2015
- Normunds Gruzitis, researcher at CSE, funded in part 2015
- Alexandra Weilenmann, researcher at ITIT, funded in part 2014–2015
- Markus Forsberg, researcher and associate professor at Språkbanken, funded in part 2015; docent since 2013
- Ellen Breitholtz, postdoc at FLoV, fully funded by CLT 2015–2016

Comment: Marcos Santos Perez från University of Malaga is an external researcher at FLoV with 6 month external financing in Dialogue Technology Lab.

(iv) Resources

(a) Equipment

- Software for Automatic Speech Recognition (Nuance)
- Driving simulator (Scaner)
- Eyetracker (SmartEye)
- Physiological stress measurement equipment (CStress)
- Servers
- Mobile devices

(b) Databases, corpora, software etc

- SIMSI corpus: interactions between drivers and dialogue systems collected in the SIMSI project. Video and audio as well as driving data and visual and cognitive distraction measurements.

- GPCC corpus: interactions between doctors and patients in diabetes care. Audio and video.
- Experimental setup for Dialogue and Distracted Driving; software and hardware linking together dialogue systems interaction with driving simulator, eyetracker, physiological stress measurement equipment.
- SALDO: a semantically organised lexicon containing morphological and lexical-semantic information for nearly 140000 lexical entries.
- Korp and Karp are the main infrastructural tools at Språkbanken for accessing corpora and lexical resources, respectively. A listing of resources can be found at <<http://spraakbanken.gu.se/eng/resources>>.
- Annotation Laboratory is a tool for annotating multilingual texts syntactically.
- Swedish Constructicon (SweCcn): A database of Swedish construction descriptions, for linguistic, language technology, and language education purposes, aligned with FrameNet and with constructicon resources for other languages.
- Grammatical Framework: a programming language for multilingual grammar applications including: GF runtime, GF cloud, GF Eclipse plugin, GF Offline Translator: an application with support for both Android and iPhone.
- Polly: a corpus tool for analysis and visualization of mobile communication.
- The CLT funding for Peter Ljunglöf has made it possible for him to be one of the core developers of NLTK – the natural language toolkit for the python programming language.
- Swedish FrameNet (SweFN): A lexical-semantic database that is based on the notion of Frame Semantics. It contains nearly 40,000 lexical units and more than 1,000 hierarchically related frames, exemplified in approximately 10,000 sentences
- Lärka (LÄR språket via KorpusAnalys) is an ICALL platform designed for learning Swedish, especially targeted towards second/foreign language learners.
- The Morphology Lab: a graphical tool for paradigm induction and lexicon extraction of historical Swedish.
- The CLT Toolkit: a set of state-of-the-art open source Language Technology tools and accompanying linguistic resources <<http://clt.gu.se/clt-toolkit>>, these include:
 - Type Theory with Records (TTR) toolkit – a framework for working with and developing record types

- MultiFraCaS: a multilingual machine readable database
- The FraCaS GF Treebank
- A Swedish Named Entity Recognizer based on Helsinki Finite-State Technology
- Resources for Automatic Speech Recognition for Swedish
- The BNF converter: a compiler construction tool generating a compiler front-end from a Labelled BNF grammar
- FM-SBLEX: computational morphology tools for modern Swedish
- TRINDIKIT: a toolkit for building and experimenting with dialogue move engines and information states
- The μ -TBL system: tools for Transformation-Based Learning
- Oz/Mozart NLP Modules: a platform for NLP
- PySCXML (pronounced pixel) supplies an SCXML parser and interpreter for the Python programming language

(c) Core user bases

- The number of users of the corpus infrastructure Korp in Språkbanken/the CLT Text Laboratory has been rising steadily since the official release of Korp v. 1.0 in October 2011. At present the number of Korp users is approximately 4000 per month. Since Språkbanken’s focus is on language resources for Swedish, it follows naturally that most users are from universities in Sweden and Finland, but the web server logs show a fair number of users from other Nordic and European countries and from USA. As other components of the CLT Toolkit Korp is open-source software, and has been installed at the universities in Helsinki (Finland), where it is used with Finnish, Swedish and multilingua corpora, and in Tromsø (Norway), where it is used for working with corpora of several Saami languages. Korp is now being set up in Copenhagen (Denmark) for Danish and Tartu (Estonia) for Estonian, and there has been interest in using Korp it also for Greek (Athens), Spanish (University of Colorado, Boulder, USA), and German (Mannheim). One important reason that Korp has become so popular as a corpus infrastructure solution is due to the effort put into making CLT Toolkit components modular and standardized, which makes Korp comparatively easy to install. The added funding for systems developer time provided by CLT has also meant that it has been possible to offer helpdesk-type assistance to external parties setting up new instances of Korp.
- The driving simulator setup (including eye tracker and physiological stress measurement equipment) has been used in the SIMSI project which involved two companies, Talkamatic AB and Mecel AB. We expect continued

collaboration with Talkamatic AB as well as new partners from the industry sector.

- The Grammatical Framework is used by approximately 30 researchers locally, and internationally the gf-dev-list has 150 members. It is also used by several Chinese universities, and by the recently established company Digital Grammars AB.

(v) Other activities

Seminars, workshops, conferences

- *Weekly CLT seminar.* Our regular seminar meets once a week with a mixed schedule of both presentations of ongoing and finished work within the centre and talks by invited guests. Many contacts have resulted in valuable international contacts. See separate appendix for list of invited guests.
- *Annual CLT workshop.* Once a year, all CLT members, together with the advisory board and a few other invited guests, go away for a few days to present papers and posters, have strategic discussions about strengthening of the LT area, evaluate the work within the centre, have thematic discussions and workshops about ongoing and future research projects.
- *CLT at Vetenskapsfestivalen 2014.* The annual international Science Festival in Gothenburg is one of Europe's leading popular science events and the only one of its kind in Sweden. CLT managed a whole section on language technology this year, and contributed a total of 22 talks, systems demonstrations and workshops.
- *Språkbankens Höstworkshop.* Since 2011 and the release of Korp v1.0 Språkbanken has had an annual workshop dedicated to a specific theme. Both local and external researchers and other interested parties have participated.
- *International Korp workshop.* The first workshop dedicated to use of Korp abroad was held in October 2014.
- *EACL 2014.* The 14th conference of the European Chapter of the Association for Computational Linguistics was hosted by CLT and the university of Gothenburg in April 2014. Two days of workshops and tutorials and three days of main conference attracted well over 500 participants, mainly from Europe, but also from the rest of the world.
- *APL, Workshop on Language, Action and Perception.* SLTC workshop, October 25, 2012, Lund

- *RBMT 2012*. The 3rd International Workshop on Free/Open-Source Rule-Based Machine Translation. June 2012, Göteborg
- *Dialogverkstad 2013*. National Workshop, Sept 2013, Göteborg. Participants: Swedish universities (KTH, Linköping, Göteborg), Swedish and international companies (Talkamatic AB, Artificial Solutions)
- *APL'2*. The Second Workshop on Language, Action and Perception. SLTC workshop, November 30, 2014, Uppsala
- *CoSLI-3*. The 3rd Workshop on Computational Models of Spatial Language Interpretation and Generation collocated with IWCS 2013 at Potsdam March 2013
- *SemDial 2015 (go:DIAL)*. Workshop on the Semantics and Pragmatics of Dialogue, September 2015, Göteborg
- *SLPAT*. International Workshop on Speech and Language Processing for Assistive Technologies July 2011 (Edinburgh, UK), June 2012 (Montréal, Canada), August 2013 (Grenoble, France), September 2015 (Dresden, Germany).
- *NAACL 2015*, Conference of the North American Chapter of the Association for Computational Linguistics June 2015 (Denver, Colorado, USA). Organised by a team of international researchers, including Peter Ljunglöf (funded by CLT)
- *International FrameNet Workshop* April 2013 (Berkeley, California, USA)
- *The GF Summer School*. August 2009 (Gothenburg), August 2011 (Barcelona, Spain), August 2013 (Lake Chiemsee, Germany). July 2015 (Gozo, Malta). Two-week summer school, organised by CLT members and international researchers.
- *The GF tutorial*. May 2010 (Language Resources and Evaluation, LREC, Valletta), August 2011 (Computer-Aided Deduction, CADE, Wroclaw), September 2012 (International Conference of Functional Programming, ICFP, Copenhagen)
- *LT-based e-HSS in Sweden – taking stock and looking ahead*. The first national SWE-CLARIN workshop, organized in conjunction with SLTC in Uppsala, November 2014.
- *SweFN++ workshop*. Gothenburg November 2014.
- *STRiX*. A workshop on semantic technologies for research in the humanities and social sciences (STRiX) in Gothenburg, November 2014.

- *Constructionist resources*. Workshop vid ICCG-8 (8th International Conference on Construction Grammar) i Osnabrück, september 2014.
- *Type Theory and Natural Language Semantics*. Workshop vid EACL 2014 co-organized by Robin Cooper, Simon Dobnik, Staffan Larsson and Shalom Lappin, Gothenburg, April 2014.
- *Type Theory and Lexical Semantics*. Workshop vid ESSLLI 2015, co-organized by Robin Cooper and Christian Retoré (LIRMM & université de Montpellier), Barcelona, August 2015.
- *GEAF*. A workshop on Grammar Engineering Across Frameworks, organized in conjunction with ACL, Beijing, July 2015.
- *Visualizing and Analyzing Mobile Communication*. Workshop organized by Ylva Hård af Segerstad in Gothenburg, May 2015.

Three companies have been launched by CLT-members:

1. *Talkamatic*. Founded by Staffan Larsson and Fredrik Kronlid <<http://talkamatic.se>>.
2. *Access and Language Technology*. Founded by Sofie Johansson Kokkinakis and Katarina Mühlenbock <<http://accesslt.se/>>.
3. *Digital Grammars*. Founded by Aarne Ranta, Markus Forsberg, Thomas Hallgren and Krasimir Angelov <<http://www.digitalgrammars.com/>>.

(vi) List of guest speakers

See appendix A.

(vii) Recognition

One of the most visible, and fundamentally important, recognition indicators we experience is the increased usage of our resources and software, both nationally and internationally, as has been commented on above. Other example indicators of increased recognition are listed here.

- CLT was chosen to organize EACL 2014 – one of the top international conferences within the area of Language Technology.
- TrindiKit, a software package maintained by CLT:s Dialogue Laboratory, is being used in research internationally, e.g. by Edinburgh University (UK).

- Elizabeth Coppock, member of the Dialogue Laboratory, was in 2013 awarded funding from the ProFutura post-doctoral programme for leading research which provides particularly promising young researchers with an extended period of financing for independent research.
- Lars Borin and Markus Forsberg were awarded “Erik Wellanders språkvårdspris” 2013 for the development of the Korp infrastructure.
- Staffan Larsson has been elected to be a substitute member of the iV&L NET (The European Network on Integrating Vision & Language) Cost Action (IC1307 MC).
- Staffan Larsson was invited to give a plenary talk at the EACL 2014 Workshop “Dialogue in Motion”.

(viii) Intangibles

There is definitely a greater perception now compared to earlier of Gothenburg as an exciting and dynamic LT research environment. This holds true both in Gothenburg and outside it. CLT members are actively extending their national and international networks, since the CLT funding makes it possible to invite new contacts with minimal bureaucratic hassle. This constitutes a clear change in attitude and behavior. CLT has to a significant extent functioned as a catalyst for promoting new initiatives, which in many cases have generated considerable external funding. CLT provides an environment and culture where the “right” thing to do is to apply for external funding, but also – more subtly – where innovative project ideas emerge more easily because of the cross-disciplinary diversity inside CLT itself, but especially in the extended network made up by the sum of contacts and collaborators brought into CLT by the individual CLT members and labs.

Financial report

A summary financial report for the period 2009 through October 2014 was submitted in connection with our preceding self-evaluation report. Here is a corresponding report covering the whole funding period (2009–2015).

The report shows a residue of 1,022 kSEK which will extend into 2016. This amount has been reserved for a postdoc position at the FLoV department with permission by Staffan Edén.

A detailed report, where costs can be traced to the four participating departments, can be made available upon request.

Amounts given in kSEK

	2009	2010	2011	2012	2013	2014	2015	Total
Income	3 750	7 500	7 500	3 750	7 500	7 500	7 500	45 000
Costs								
Administration, management	48	271	382	309	292	307	440	2 049
Junior research support	113	730	2 828	2 337	1 153	1 670	1 575	10 406
Research engineers, system developers	193	1 015	1 310	2 211	1 107	2 107	1 602	9 545
Equipment	0	21	50	230	180	248	229	958
Workshop organization	0	133	177	213	138	200	296	1 157
Travel, conference fees, guests	0	271	944	1 115	733	972	1 130	5 165
Other, e.g., digitization, printing, annotation	0	0	0	89	239	73	51	452
OH etc	274	1 455	2 811	3 246	1 614	2 473	2 373	14 246
Total costs	628	3 896	8 502	9 750	5 456	8 050	7 696	43 978
<i>Balance</i>								1 022

A Appendix: List of guest speakers at the CLT seminar

1. Hans Akkermans, University Amsterdam
2. Tobias Berg, Findwise
3. Chris Biemann, TU Darmstadt
4. Björn Bringert, Google
5. Marco Buehler, Georg August University Göttingen
6. Nicoletta Calzolari, National Research Council
7. Nancy Chang, Berkeley University
8. Christian Chiarcos, Universität Potsdam
9. Bernard Comrie, University of California
10. Cleo Condoravdi, Stanford University
11. Paul Cook, University of Melbourne
12. Robert Dale, Macquarie University
13. Thierry Declerck, German Research Center for Artificial Intelligence
14. Sandra Derbring, DART
15. Maarten de Rijke, Intelligent Systems Lab Amsterdam
16. Arash Eshghi, Heriot Watt University's Interaction Lab
17. Peter Exner, LTH, Lund University
18. Thomas François, CENTAL (Université catholique de Louvain)
19. Andrew Gargett, Saarland University
20. Jonathan Ginzburg, Université Paris Diderot
21. Stefan Gries, University of California
22. Harald Hammarström, Max Planck Institute for Psycholinguistics
23. Patrick Hanks, University of Wolverhampton
24. Jey Han Lau, King's College
25. Mattias Heldner, Stockholm University

26. Lars Hellan, Trondheim University
27. Graeme Hirst, Toronto University
28. Anna Hjalmarsson, KTH
29. Larry Horn, Yale University
30. Måns Huldén, Helsingfors University
31. Anette Hulth, Swedish Institute for Communicable Disease Control
32. Peter Ingwersen, The Royal Danish Academy of Fine Arts
33. Matthew Jockers, University of Nebraska
34. Maria Johansson, Findwise
35. Gerhard Jäger, University of Tübingen
36. Anni Järvelin, Tammerfors University
37. Kalervo Järvelin, Tammerfors University
38. Daniel Keim, Konstanz University
39. John Kelleher, School of Computing, Dublin Institute of Technology
40. Adam Kilgarriff, Lexicography Masterclass
41. Christos Koniaris, KTH
42. Valia Kordoni, Humboldt University
43. Kimmo Koskenniemi, University of Helsinki
44. Steven Krauwer, Utrecht University
45. Fredrik Kronlid, Talkamatic AB
46. Marco Kuhlmann, Uppsala University
47. Andrew Kun, University of New Hampshire
48. Shalom Lappin, King's College
49. Hans Leiß, LMU, München
50. Peter Leonard, Yale University Library
51. Maria Liakata, University of Warwick
52. Krister Lindén, Helsingfors University

53. Pierre Lison, University of Oslo
54. Johann-Mattis List, Marburg University
55. Hrafn Loftsson, Reykjavik University
56. Sverker Lundin, University of Gothenburg
57. Mats Lundälv, DART
58. Wolfgang Maier, University of Düsseldorf
59. John McCrae, Bielefeld University
60. Michael McTear, Computer Science Research Institute, University of Ulster
61. Beáta Megyesi, Uppsala University
62. Detmar Meurers, Tübingen
63. Detmar Meurers, Tübingen University
64. Paul Meurer, Uni research, University of Oslo
65. Eleni Miltsakaki, University of Pennsylvania
66. Alessandro Moschitti, Trento University
67. Kristiina Muhonen, Helsingfors University
68. Arto Mustajoki, University of Helsinki
69. Roberto Navigli, Sapienza University of Rome
70. John Nerbonne, Groningen University
71. Kristina Nilsson Björkenstam, Stockholm University
72. Joakim Nivre, Uppsala University
73. Pierre Nugues, LTH, Lund University
74. Daniela Oelke, Konstanz
75. Jeffrey Parrott, LANCHART, Copenhagen
76. Bolette Pedersen, University of Copenhagen
77. Julia Pennlert, Umeå university
78. Maciej Piasecki, University of Wrocław
79. Barbara Plank, University of Copenhagen

80. Laurette Pretorius, University of South Africa
81. Tanja Purtonen, Helsingfors University
82. Paul Rayson, Univ. Lancaster
83. Miriam R L Petruck, International Computer Science Institute (ICSI)
84. Angus Roberts, Sheffield
85. Mikael Roll, Lund University
86. Victoria Rosén, Uni research, University of Oslo
87. Josef Ruppenhofer, Universität Hildesheim
88. Ivan Sag, Stanford University
89. Magnus Sahlgren, Gavagai
90. Victor Sánchez-Cartagena, Universitat d'Alacant
91. Marina Santini, Artificial Solutions
92. Srikant Sarangi, Health Communication Research Centre, Cardiff University
93. Nathan Schneider, University of Edinburgh
94. Stefan Schulz, Freiburg
95. Mike Scott, Lexical Analysis Software Ltd
96. Frédérique Segond, Viseo
97. Gabriel Skantze, KTH
98. Caroline Sporleder, Trier University
99. Richard Sproat, Oregon Health & Science University
100. Mark Steedman, Edinburgh
101. Pavel Straňák, Charles University in Prague
102. Claes Strannegård, University of Gothenburg
103. Anders Søgaard, University of Copenhagen
104. Nina Tahmasebi, Leibniz University Hannover
105. He Tan, Linköping University
106. Joel Tetreault, Yahoo

107. Jörg Tiedemann, Uppsala University
108. Tiago Timponi Torrent, Federal University of Juiz de Fora
109. Erik Tjong Kim Sang, Meertens Institute
110. Staffan Truvé, Recorded future
111. Reut Tsarfaty, Uppsala University
112. Francis Tyers, Apertium
113. Oscar Täckström, Google
114. Christina Unger, Bielefeld University
115. Sowmya Vajjala, Tübingen University
116. Andreas van Cranenburgh, University of Amsterdam
117. Martin Volk, Zürich University
118. Shuly Wintner, University of Haifa
119. Torsten Zesch, University of Duisburg-Essen
120. Lilja Øvrelid, University of Oslo

B Appendix: CLT publications 2009–2015/in press (572 pubs)

= authors/editors from several faculties, universities, etc.

* = publications resulting from CLT funding

NB: This list of publications is not identical to that found on the CLT website: <<http://clt.gu.se/publicationsu>>. The latter is automatically generated from the university publication database on the basis of the CLT membership roster, whereas in the list presented below publications judged to fall outside the field of language technology have been removed.

2009 (56 pubs)

- # Andréasson, Maia, Borin, Lars, Forsberg, Markus, Beskow, Jonas, Carlson, Rolf, Edlund, Jens, Elenius, Kjell, Hellmer, Kahl, House, David, Merkel, Magnus, Forsbom, Eva, Megyesi, Beáta, Eriksson, Anders, and Strömquist, Sven. Swedish CLARIN activities. *Proceedings of the Nodalida 2009 workshop on CLARIN activities in the Nordic countries. NEALT Proceedings Series*, vol. 5, pp. 1-5, 2009.
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- * Borin, Lars, Dannélls, Dana, Forsberg, Markus, Toporowska Gronostaj, Maria, and Kokkinakis, Dimitrios. Thinking Green: Toward Swedish FrameNet++. *FrameNet Masterclass and Workshop*, 2009.
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- Dannélls, Dana. The Value of Weights in Automatically Generated Text Structures. *Proceedings of the 10th International Conference on Intelligent Text Processing and Computational Linguistics*, no. LNCS 5449, pp. 233-244, 2009.
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- Hammarström, Harald. *Unsupervised Learning of Morphology and the Languages of the World*. Doctoral thesis, 2009.
- Johansson Kokkinakis, Sofie. Readability and Multilingualism. *Multilingualism, Proceedings of the 23rd Scandinavian Conference of Linguistics*, vol. Studia Linguistica Upsaliensia 8, no. Acta Universitatis Upsaliensis, pp. 323-324, 2009.
- # Johansson Kokkinakis, Sofie and Lindberg, Inger. Cross disciplinary and discipline specific words in Swedish secondary school textbooks.. *19th Annual Conference of the European Second Language Association, Cork, Ireland*, 2009.
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- # Allwood, Jens, Hammarström, Harald, Hendrikse, A.P., Ngcobo, M.N., Nomdebevana, Nozibele, Pretorius, Laurette, and van der Merwe, Mac. Work on Spoken (Multimodal) Corpora in South Africa. *Calzolari, N, Choukri, K, Maegaard, B, Mariani, J., Odijk, J, Piperidis, S, Rosner, M. & Tapias, D. (Eds.) Proceedings of the Seventh conference on International Language Resources and Evaluation (LREC'10) Valetta, Malta May 19-21. European Language Resources Association (ELRA)*. <http://www.lrec-conf.org/proceedings/lrec2010/index.html> (ALLWOOD 10.438)., 2010.
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- # Breitholtz, Ellen, Ericsson, Stina, Lundholm Fors, Kristina, and Villing, Jessica. A Multi-Dimensional Study of Cognitive Load in Dialogue. *NorDisCo, Aalborg, 17th - 19th November 2010*, 2010.
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