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Linguistic Technology Systems

Welcome to **Linguistic Technology Systems**, where conversation analysis meets computer technology. We have found that people follow specific conversational sequence patterns when they talk, regardless of their language. These patterns can be detected algorithmically (from words, prosody and spacing), and used to enhance machine understanding of the human dialog in many ways. We call this process "Sequence Package Analysis" or **SPA**, and it lies at the heart of our business.

In the News

SPA is an effective tool that can speed up the development of grammars that better match how callers truly express themselves across many different languages and dialects. ... SPA technology provides one possible solution to "voicemail hell."
(Speech Technology Magazine's **NewsBlast**, February 25, 2004)

Dr. Neustein outlines her pioneering work in speech recognition and how it relates to call center and government security applications [and] revolutionary ways in which speech technology can better meet international needs. (**Globalization Insider / LISA Newsletter**, February 18, 2004)

The Sequence Package Analysis voice technology tool will be among the items discussed at the upcoming Speech 2001 Exposition and Conference in New York.... Sequence Package Analysis may also prove useful in call centers, voice portals, and other applications. (JUSTNET -- **Law Enforcement and Corrections Technology News Summary**, National Institute of Justice, October 18, 2001)

Even when law enforcement officials are able to listen in on the conversations of suspected terrorists ... wading through the massive amount of data ... is an enormous task. Linguistics expert Dr. Amy Neustein predicts that a new voice technology tool called Sequence Package Analysis will play a key role in making the job easier. ("Linguistic Expert Predicts Voice Technology Will Play Pivotal Role in Spotting Terrorists," **BusinessWire**, October 11, 2001)

[In the] *International Journal of Speech Technology*, Dr. Neustein described how sequence package data can be mapped into algorithms. (Speech Technology Magazine's **NewsBlast**, October 10, 2001)

Volgens computerlinguïsten kan een nieuwe spraaktechnologie, Sequence Package Analysis (SPA) genaamd, een cruciale rol spelen in de strijd tegen terrorisme.
[Linguists have developed a new speech technology, called Sequence Package Analysis (SPA), which is playing a vital role in the fight against terrorism.]
(**Automatisering Gids**, September 19, 2001)

Product Applications

SPA is useful in the following application areas:

- Interactive Voice Response (IVR)
- Call Center quality monitoring: gathering business intelligence data; detecting emotion in calls; and agent training
- Audio Data Mining of VoIP conference calls
- Mining government wiretaps and recorded communications of terror suspects
- Mining recorded doctor-patient dialog
- Mining e-mails and blogs

SPA enhances the delivery of speech technology in call centers. Businesses have increasingly come to rely on call centers for customer service and have tried to introduce automation during different phases of the call, from initial call routing to the analysis of recorded customer-agent dialog. Since the purpose of automation is to reduce the costs of using live agents or to handle the caller-agent calls more efficiently, the majority of vendors in the call center quality monitoring and IVR industry have focused on speech technology as a way to improve upon their applications.

The industry still faces an important challenge. With the addition of automated speech recognition (ASR) for example, calls are still improperly routed, and users themselves are “zeroing out” or hanging up altogether on conversational response or IVR systems. Similarly, even with the improvements in data mining programs, call centers have a hard time identifying the “frustrated” customers who require escalation of their call to a supervisor. **SPA** closes this gap in the speech technology industry by adding software to speech recognizers (and to automated e-mail response systems) that enables speech systems to better understand variations in human speech along with the complexities of human emotions.



Publications

by Amy Neustein, Ph.D.

1984

- Linguistic Technology and Artificial Intelligence in Medical History-Taking. *Update: Computers in Medicine*, Vol. II (5), October (pp. 56-60)

1985

- The Linguistic Screening Module: Effective Monitoring of the Pacemaker Patient. *Update: Computers in Medicine*, Vol. III (2), March (pp. 11-14)

1986

- Dynamics of the Doctor-Patient Interview: What Happens When the Physician Interrupts the Patient? *Osteopathic Medical News*, Vol. III (4), April (pp. 28-32)
- New Ways to Interview Effectively. *The Investigative Reporters and Editors Journal*, Vol. 9 (3), Summer (pp. 8-9)
- Getting Straight Answers from Experts: A Comprehensive Guide to What they Appear to be Saying. *The Judges' Journal*, Vol. 25 (3), Summer (pp. 30-34)
- Reprint, *Ibid.*, *The Los Angeles Daily Journal*, No. 86-19 (October 10) (pp. 13-17)
- Computer-Aided Instruction for Improving History-Taking Skills (Part I). *Physicians and Computers*, Vol. 4 (6), October (pp. 32-36)
- Computer-Aided Instruction for Improving History-Taking Skills (Part II). *Physicians and Computers*, Vol. 4 (7), November (pp. 33-37)

1989

- Medical History-Taking as an Interactive Event. In *Doctor-Patient Interaction*, Walburga von Raffler-Engel (ed) Amsterdam/Philadelphia: John Benjamins Publishing Co. (pp. 61-77)

1999

- How Sequence Packages Can Aid Language Understanding. *Speech Technology Magazine*, Vol. 4 (4), June/July (pp. 36-37)

2000

- Designing the Virtual Agent: Some Theoretical and Practical Considerations. *Call Center News Service*, Vol. 4 (24): (December 4) (pp. 1-4)

2001

- Using Sequence Package Analysis to Improve Natural Language Understanding. *International Journal of Speech Technology*, Vol. 4 (1): (pp. 31-44)

- Software Paves Way for Dialogue: Montreal Developer Designs Programs Allowing People to Speak Naturally to "Virtual Agent." *Montreal Gazette* (June 7) (p. B5).
- Your Voice is My Command: Computers Controlled by the Human Voice. *Info-World CTO Zone* (June 27).
- Linguistics Expert Predicts Voice Technology will Play Pivotal Role in Spotting Terrorists. *Speech Technology Magazine's NewsBlast*, Vol. 1 (41) (October 10).
- Linguistics Expert Predicts Voice Technology will Play Pivotal Role in Spotting Terrorists. *BusinessWire* (October 11).
- Spraaktechnologie is must voor inlichtingendiensten: Amerikaanse overheid investeerd al jarenlang in taaltechnologie. *Automatisering Gids*, Den Haag (October 19) (p. 5)
- Why Linguistics is Important for the Design of a Non Fictional Hal? *SpeechTEK 2001* (October 26)
- The Linguistics of a Non-Fictional Hal. *EjTalk* (October 29)
- Why Linguistics is Important for the Design of a Non Fictional HAL? Reprint of SpeechTEK published White Paper in *NextInterface.net*. (November)

2002

- Ring In the New Year: Telephones Gain A New Improved Technology for Accessing the Web. *NextInterface.net* (February/March)
- Untangling How Users Interact with the Voice Web: Building Intelligence into Voice-Based Apps. *NextInterface.net* (April)
- Untangling V-Commerce: Building Intelligence into Voice-Based Apps. *Wireless-Report* (April)
- Sequence Package Analysis: A Data Mining Tool to Speed Up Wiretap Analysis. *AVIOS* (Applied Voice Input/Output Society) (May 10)
- Sequence Package Analysis: A Data Mining Tool to Speed Up Wiretap Analysis. Reprint of AVIOS published White Paper in *SecureFrontiers.net* (May)
- "Smart" Call Centers: Building Natural Language Intelligence Into Voice-Based Apps. *Speech Technology Magazine*, Vol. 7 (4): (pp. 38-40)

2004

- Sequence Package Analysis: A New Global Standard for Processing Natural Language Input? *LISA Newsletter*, Vol. 13 (1.2): (pp. 1-6) (February 18)
- Sequence Package Analysis: A New Global Standard for Processing Natural Language Input? Reprint in *Speech Technology Magazine's NewsBlast* (February 25)
- Sequence Package Analysis: A New Natural Language Understanding Method for Performing Data Mining of Help-Line Calls and Doctor-Patient Interviews. In B. Sharp (Ed.), *Proceedings of the 1st International Workshop on Natural Language Understanding and Cognitive Science*, University of Portugal (April 13)

2005

- A New Natural Language Method for Performing Efficient Mining of Government Tape-Recordings of the Conversations of Terror Suspects. *IEEE* (ITCC, IAS Track) (April 11)



Presentations

by Amy Neustein, Ph.D.

2001

- "Why Linguistics is Important for the Design of a Non Fictional HAL?" *SpeechTEK 2001* (October 26)

2002

- "Sequence Package Analysis: A Data Mining Tool to Speed Up Wiretap Analysis" *AVIOS* (Applied Voice Input/Output Society) (May 10)
- "Advanced Natural Language Understanding" (moderator of panel), *SpeechTEK 2002 International Exposition and Educational Conference* (October 30)

2003

- "Sequence Package Analysis: A New Natural Language Intelligence Method for Speeding Up Wiretap Analysis" *Second Annual Research Symposium of Human Language Technology Research Institute*, University of Texas, Dallas (March 11)
- "Filling the Global Communications Gap" (panelist at Plenary session). Accelerating Global Understanding, *Annual Meeting of the General Assembly of the LISA Forum USA*, Washington, D.C. (December 9)
- "Building Standards for Global Speech Applications" (workshop panelist). Accelerating Global Understanding, *Annual Meeting of the General Assembly of the LISA Forum USA*, Washington, D.C. (December 10)

2004

- "Sequence Package Analysis: A New Natural Language Understanding Method for Performing Data Mining of Help-Line Calls and Doctor-Patient Interviews" Presentation at the *1st International Workshop on Natural Language Understanding and Cognitive Science*, University of Portugal (April 13)
- "Sequence Package Analysis: a New NLU Method for Improving Speech Capabilities in Spoken Language Understanding Systems" AT&T, *VoiceTone Project* (May 24)
- "Mining for What's Missing: How to Find What is not in the Speech Application's Vocabulary" *SpeechTEK 2004* (September 15)
- "Using a New Method of Natural Language Intelligence for Performing Wiretap Analysis" *Policy Sciences Center Annual Institute at Yale Law School* (October 23)



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About LTS

LTS is a speech technology company focused on the development of intelligent software for speech recognition systems, as used in call centers for call routing and call mining purposes. Because this software is adaptable to any speech platform, it can be deployed across many different applications. The software is designed to improve analysis of natural language speech input so that speech systems can better adapt to the wide variations in human speech and human emotion. The software may also be used to glean critical business intelligence and emotional data from electronic communications, such as e-mails and blogs, which closely resemble conversational dialog.

LTS is the originator of a new and advanced speech application technology, Sequence Package Analysis (**SPA**). The research findings of **SPA** have been successfully refereed by engineers and linguists, and cited by other computer scientists as a useful data-mining method.

Management Team



Founder, CEO and CTO **Amy Neustein**, Ph.D. (Boston University, Department of Sociology, specialty in conversation analysis) serves on the Editorial Advisory Board of *Speech Technology Magazine* and performs peer review for the *International Journal of Speech Technology* and various publications of IEEE. Her work on **SPA** appears widely in peer-reviewed literature and in industry publications. Dr. Neustein has lectured both at industry events and academic institutions on the development of **SPA**. She has served on distinguished panels with Oracle, Audium and other companies, and has presented to AT&T's VoiceTone Project.



Director of Medical Engineering **Alan Rowberg**, M.D. (University of Washington, School of Medicine; Johns Hopkins University, MS computer science) is an expert in medical information technology and related computer engineering. Dr. Rowberg served as the Chief of the Computer Science Office of the United States Army Medical Research Institute for Infectious Diseases (USAMRIID), and in the private sphere as a consultant to Litton PRC, now Northrop Grumman. He has recently been consulting for a variety of start-up information-technology companies.



Chief Legal Officer **Michael Lesher**, Esq. (University of Virginia, M.A. with honors, 1982; Brooklyn Law School, J.D. *cum laude*, 1988) is a member of the New York bar. He has helped craft business agreements and handled business-related litigation with the firm of Lauterbach Garfinkel Damast & Hollander, LLP, to which he is "of counsel." He has also handled federal civil rights cases concerning freedom of speech and equal protection under the law. As a legal writer, Michael has contributed to such publications as *Moore's Federal Practice*, *Weinstein's Evidence*, and *The Federal Litigation Guide Reporter*.



Chief Financial Officer **Yaakov Kronfeld** (Harvard Business School, MBA) is an entrepreneur who has established two successful HMOs. The first started with capital of \$250K and within four years produced a 100-fold return on investment. The second, in which he was founder and majority owner, had an initial investment of \$2M, and resulted in a five-fold ROI within six years.

Advisory Board

- Mariam Bell, Washington lobbyist; former Department of Health and Human Services Deputy Assistant Secretary; and former White House aide
- Daryle Gardner-Bonneau, Ph.D., Editor-in-Chief, *International Journal of Speech Technology*
- Mary Carol Day, Ph.D., Human Factor Design specialist, Verizon consultant
- Emiel Kraemer, Ph.D., Assistant Professor of Linguistics at *Eindhoven University of Technology*, The Netherlands
- Walt Nawrocki, CEO of Intraco
- K W (Bill) Scholz, Ph.D., Architect Director, Voice and Business Mobilization Solutions, Unisys
- Frank Wander, VP of Development, Business Edge Solutions
- Barry Zellen, Publisher and Editor-in-Chief, *NextInterface*, *WirelessReport*, and *SecureFrontiers*



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About This Web Site

The site page layout and color usage are designed by Valerie Promise, of Promised Land Productions. Photo of Amy Neustein is by Suzanne Matthau. PDFs are produced using Adobe Acrobat.

The site is available as:

- **PDF** (138K), with graphics and links to PDFs and PPTs
- **HTML** in a .zip file (47K), with graphics and links to PDFs and PPTs
- **HTML** in a .zip file (891K), complete with all referenced PDFs and PPTs

Privacy

We respect the right of our readers to privacy. We will not contact anyone as a result of their accessing this site, nor will we reveal the identities of readers to any third parties except as legally required for law-enforcement purposes.

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