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How to reap the benefits of language for psychiatry

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ABSTRACT

Our aim is to find accurate and valid markers for diagnosis, prognosis, and the monitoring of treatment to improve outcome for patients with schizophrenia-spectrum disorders. This search has led us into the disciplines of computational linguistics and artificial intelligence, as automatic analysis of spoken language may provide useful markers for psychiatry. Together with our language team at UMC Groningen and with great colleagues around the globe, we intend to push this field forward and provide tools that can support service users in self-monitoring and help clinicians with diagnosis, treatment monitoring and risk prediction.

The authors aim to find accurate and valid markers for diagnosis, prognosis, and the monitoring of treatment to improve outcome for patients with schizophrenia-spectrum disorders. This search has led them into the disciplines of computational linguistics and artificial intelligence, as automatic analysis of spoken language (henceforth: speech) may provide useful markers for psychiatry. Iris started this search in 1997 and teamed up with Janna in 2012, which intensified their focus on language.

Iris started her career as a researcher with a PhD project, investigated language in individuals with schizophrenia using functional MRI. She demonstrated a lower degree of language lateralization in relation to the genetic liability for psychosis (Sommer et al., 2004), which the eminent Tim Crow had predicted earlier (1997). In addition to the differences in connectivity of the language network that had already been observed and described by Lynn DeLisi (2001), she also investigated speech using the Thought and Language Index developed by yet another hero of psychiatry, Peter Liddle (2002). These early investigations convinced her of the rather large deviations present in speech of individuals with psychosis. In the case of formal thought disorder (FTD), these speech deviations are detected during psychiatric examination, but also people without FTD have rather unequivocal deviations in speech when investigated quantitatively. Unfortunately, the transcription and quantitative analyses of speech by hand is very time consuming and therefore not applicable for clinical practice.

While language lateralization was clearly different between participants with psychosis and healthy participants, most deviations assessed with MRI were rather subtle. This was true for both structural and functional variables (Sommer and Kahn, 2015). Quite large groups (n = 50 or more) were needed to find consistent differences and many people with psychosis were within the normal range. This led to the conclusion that MRI could not be the way to go in search of a valid biomarker for schizophrenia-spectrum disorders. Sabine Bahn, did ground-breaking work using blood-based biomarkers, but arrived to more or less the same conclusion: blood markers were not accurate enough to be used as a biomarker for schizophrenia. Being both a clinician and a researcher, Iris was confronted with the insufficiency of current therapies for schizophrenia-spectrum disorders on a daily base. Being incapable of providing for the patient's needs, urged her to work hard as a researcher to help build a better future. It also made her a very practical researcher, interested mostly in topics that could lead to better diagnosis and treatment on the short term.

After her PhD, Iris started the Voices Clinic and her research was largely devoted to understanding hallucinations, as this was an area that would allow her to make a difference. In 2012, she met with the young doctor and linguist Janna de Boer, who provided the much needed deeper understanding of linguistics, which marked a return from hallucinations to language. Together, Janna and Iris analyzed the language of auditory verbal hallucinations, which provided important directions as to its origin (de Boer et al. 2016). The collaboration with Janna sparked the interest and ambition to develop a multidisciplinary research line combining linguistics with psychiatry, and to team up with national and international collaborators. It was easy to make big steps in this field, when standing on the shoulders of giants, as language in schizophrenia is one of the best researched areas (see DeLisi, 2021 for an historical overview). Language production can be seen as a reflection of a person's thoughts and the use of structured analysis of speech is a powerful tool to quantify them. In this sense, Tim Crow's statement that the only valid animal model of schizophrenia would be a talking mouse

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can only fully be agreed upon, as language is a central concept in schizophrenia. Auditory verbal hallucinations are a misperception of internally produced language (verbal thoughts), the derailment of the form of speech reflects thought disorder, and deviations in the content of speech can reflect delusions. All these deviations can be quantified using natural language processing (NLP) and/or acoustic analyses. A series of investigations (de Boer et al., 2022, 2021; Voppel et al., 2021) support these statements.

In the meantime, Brita Elvevåg had shown convincingly that thought disorder could be quantified using automated latent semantic analyses (Elvevåg et al., 2007). Some years later, Cheryl Corcoran and her group showed that the same NLP tool can provide an excellent predictor of the conversion from the ultra-high-risk stage to psychosis (Bedi et al., 2015). Their findings increased enthusiasm around the world to use speech as a marker for diagnosis and treatment monitoring. Under the devoted leadership of Schizophrenia International Research Society (SIRS) 2018 rising star, Lena Palaniyappan, the global Discourse in Psychosis Consortium (https://discourseinpsychosis.org/) was founded, which focuses on the multimodal nature of speech and studies mechanisms underlying thoughts, language and communication disturbances in psychosis. This consortium connects researchers who apply linguistics to schizophrenia-spectrum disorders and offers a platform for (virtual) meetings, data sharing and discussion.

In this consortium, important partners such as Brita Elvevåg, Natalia Mota, Sunny Tang, Eric Tan, Philipp Homan and Wolfram Hinzen join forces to make the necessary step towards clinical usefulness of speech marker. In particular, they see the possibility to use speech as a prediction of psychotic relapse. Psychotic relapse can be such a disappointment for patients and their family and nihilate initial success in personal and professional recovery. In this era when maintenance therapy is no longer acceptable for many patients (Sommer et al., 2019), accurate and timely prediction of relapse is the single most important thing to keep patients in a steady line of recovery. If the hard work in grant-writing pays off, they may be able to develop a valuable tool that either patients or clinicians could use to help predict psychotic relapse in a timely manner.

The idea regarding a speech marker for schizophrenia-spectrum diagnosis and treatment monitoring was selected in 2021 as one of the four Dutch AI moonshot projects by the NL-AI-coalition (https://nlaic.com/agenda/webinar-innovaties-in-de-zorg-hersenen/). Janna de Boer together with Alban Voppel won the 2020 Dutch Scientific Research Council (NWO) OpenMind Award for this application (https://www.nwo.nl/nieuws/vijf-out-box-ideeen-krijgen-open-mind-beurs). In 2021, Iris was awarded a distinguished fellowship to further this line of research at the Netherlands Institute of Advanced Sciences (NIAS). In her soon to be published PhD thesis, Janna selected the term 'computational psycholinguistics' for this booming area of research. Together with the language team at UMC Groningen and with great colleagues around the globe, they intend to push this field forward and provide tools that can support service users in self-monitoring and help clinicians with treatment monitoring and risk prediction.

Declaration of Competing Interest

Authors Iris E. Sommer and Janna de Boer state that they have no conflict of interest related to this manuscript. Nor have they received fees for promoting the work of this manuscript.

References

Bedi, G., Carrillo, F., Cecchi, A., Slezak, D.F., Sigman, M., Mota, N.B., Ribeiro, S., Javitt, D.C., Copelli, M., Corcoran, C.M., 2015. Automated analysis of free speech predicts psychosis onset in high-risk youths. NPJ Schizophr. 26 (1), 15030. https://doi.org/10.1038/npjschz.2015.30.

Crow, T.J., 1997. Is schizophrenia the price that Homo sapiens pays for language? Schizophr. Res. 28, 127–141. https://doi.org/10.1016/S0920-9964(97)00110-2.

de Boer, J.N., Heringa, S.M., van Dellen, E., Wijnen, F.N.K., Sommer, I.E.C., 2016. A linguistic comparison between auditory verbal hallucinations in patients with a psychotic disorder and in nonpsychotic individuals: not just what the voices say, but how they say it. Brain Lang. 162, 10–18. https://doi.org/10.1016/j.bandl.2016.07.011.

de Boer, J.N., Voppel, A.E., Brederoo, S.G., Schnack, H.G., Truong, K.P., Wijnen, F.N.K., Sommer, I.E.C., 2021. Acoustic speech markers for schizophrenia-spectrum disorders: a diagnostic and symptom-recognition tool. Psychol. Med. 4, 1–11. https://doi.org/10.1017/S0033291721002804.

de Boer, J.N., Corona-Hernández, H., Gerritse, F., Brederoo, S.G., Wijnen, F.N.K., Sommer, I.E., 2022. Negative content in auditory verbal hallucinations: a natural language processing approach. Cogn. Neuropsychiatry 27 (2–3), 139–149.

DeLisi, L.E., 2001. Speech disorder in Schizophrenia: review of the literature and new study of the relation to uniquely human capacity for language. Schizophrenia Bull. 27, 481–496. https://doi.org/10.1093/oxfordjournals.schbul.a006889.

DeLisi, L.E., 2021. Historical pursuits of the language pathway hypothesis of schizophrenia. NPJ Schizophr. 9 7 (1), 53. https://doi.org/10.1038/s41537-021-00182-z.

Elvevåg, B., Foltz, P.W., Weinberger, D.R., Goldberg, T.E., 2007. Quantifying incoherence in speech: an automated methodology and novel application to schizophrenia. Schizophr. Res. 93 (1–3), 304–316. https://doi.org/10.1016/j.schres.2007.03.001.

Liddle, P.F., Ngan, E.T., Caissie, S.L., Anderson, C.M., Bates, A.T., Quested, D.J., White, R., Weg, R., 2002. Thought and Language Index: an instrument for assessing thought and language in schizophrenia. Br. J. Psychiatry 181, 326–330. https://doi.org/10.1192/bjp.181.4.326.

Sommer, I.E., Ramsey, N.F., Mandl, R.C., van Oel, C.J., Kahn, R.S., 2004. Language activation in monozygotic twins discordant for schizophrenia. Br. J. Psychiatry 184, 128–135. https://doi.org/10.1192/bjp.184.2.128.

Sommer, I.E., Kahn, R.S., 2015. The contribution of neuroimaging to understanding schizophrenia; past, present, and future. Schizophr. Bull. 41 (1), 1–3. https://doi.org/10.1093/schbul/sbu141.

Sommer, I.E.C., Oomen, P.P., Hasan, A., 2019. Maintenance treatment for patients with a first psychotic episode. Curr. Opin. Psychiatry 32 (3), 147–156. https://doi.org/10.1097/YCO.0000000000000494.

Voppel, A.E., de Boer, J.N., Brederoo, S.G., Schnack, H.G., Sommer, I.E., 2021. Quantified language connectedness in schizophrenia-spectrum disorders. Psychiatry Res. 304, 114130 https://doi.org/10.1016/j.psychres.2021.114130.