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# Support for a novel, simple method for calculating word frequency of output on language production tasks

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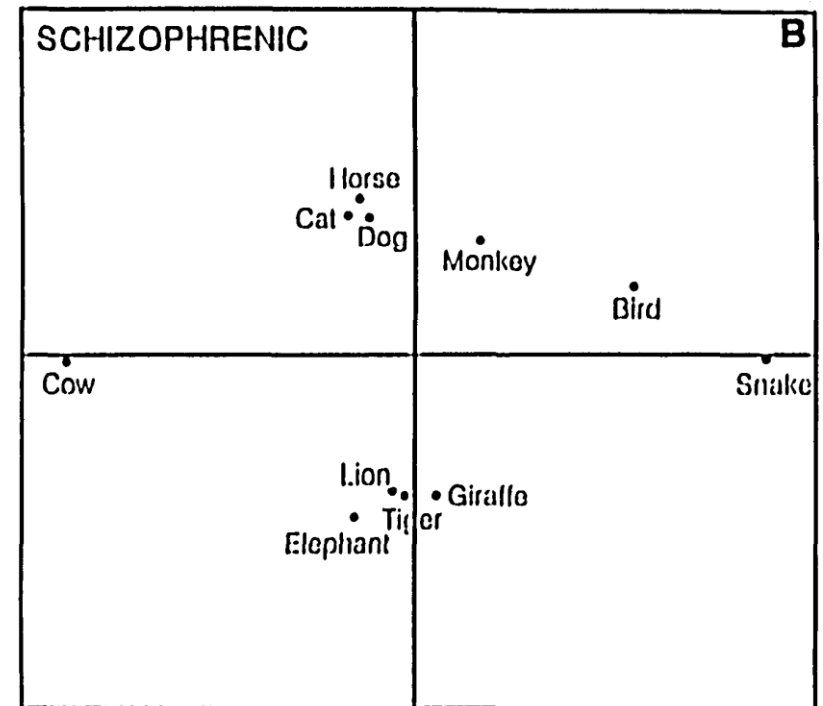
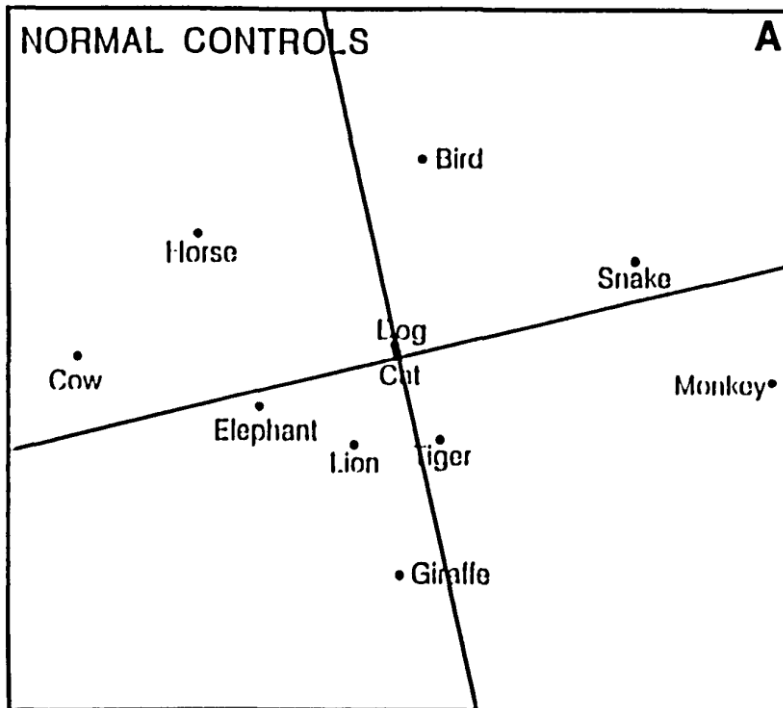
# BACKGROUND

## Language in schizophrenia

- Patients with schizophrenia (SCH) display diverse abnormalities in linguistic and specifically lexical processing
- Research using verbal fluency:
  - Reduced productivity
  - Atypical word clustering
  - Associations with psychotic symptoms

# BACKGROUND

## Language in schizophrenia



Aloia et al. (1996). *J. Int. Neuropsychol. Soc.* 2(4), 267–273. <https://doi.org/10.1017/S1355617700001272>

# BACKGROUND

## Word frequency (WF) effect in schizophrenia

- Patients with schizophrenia exhibit similar WF effects on lexical tasks compared to healthy subjects (Brébion et al., 2005; Rossell & Batty, 2008; Tan et al., 2016)
- Some obtained different results (Condray et al., 2010; Huron et al., 1995; Maher et al., 1983; Rossell & David, 2006)
- One study on word frequency on verbal fluency (Juhasz et al., 2012)

# BACKGROUND

## Corpus-based WF

- Corpora:
  - Usually constructed from written language data
  - Natural WF is non-normally distributed
  - Not all word forms, meanings, and uses can be documented in a single corpus
  - Corpora are not typically updated at (linguistically) short intervals
  - Adequately equipped corpora are not available for all languages of the world

# AIMS OF THE STUDY

## Corpus-based vs. within-sample word frequency

- We tested whether there is a relationship between the severity of positive and negative symptoms in patients with SCH and the frequencies of the words produced on two verbal fluency tasks
- Within-sample WF:
  - Representative of language use in the given sample on the given task
  - Distribution should be normal or closer to normal
  - Zero frequency words are avoided
  - Synchronicity is ensured
  - Dependence on annotated corpora is abolished

# METHODS

## Patients

- 36 German-speaking in- and outpatients diagnosed with schizophrenia (F20.x) according to ICD-10 criteria
- Symptom assessments: SAPS and SANS

**Table 1.** Sociodemographic and clinical data for the patients ( $n = 36$ )

	Mean	SD	Range
Age (years)	37.89	11.32	21–65
Education (years)	10.14	1.64	8–13
Sex	9/36 females (25.0 %)		
SAPS	27.19	24.08	0–91
SANS	31.19	18.85	2–72



# METHODS

## Verbal fluency

- Semantic fluency (SF): *animals*
- Letter fluency (LF): <p>
- 60 seconds
- Output was audio-recorded, transcribed (ELAN, 2019; Wittenburg et al., 2006), and assessed according to Aschenbrenner et al. (2001)
- Output was assigned: 1) a corpus-based WF (from dlexDB; Heister et al., 2011) and 2) a within-sample WF value

# RESULTS & DISCUSSION

## Descriptive data

**Table 2.** Descriptive data for the two word frequency variables

	Mean (SD)	Range	W	Skewness	Kurtosis
corpus-based WF SF	753.000 (389.940)	164.5–1293	.005	-0.040	-1.416
within-sample WF SF	10.681 (2.274)	5.667–15.545	.479	0.283	0.081
corpus-based WF LF	483.667 (471.999)	17–2411	< .001	2.301	7.175
within sample WF LF	2.202 (0.634)	1–3.417	.587	-0.123	-0.750

# RESULTS & DISCUSSION

## Descriptive data

- Different methodological frameworks may have better use of one or the other variable type
- Without data transformation, parametric tests may be unsuitable for the analyses of corpus-based WF on VF

# RESULTS & DISCUSSION

## Correlational analyses

**Table 3.** Correlations between the global score and the four subscale scores of the SAPS, and the two word frequency variables

	SAPS	Hallucinations	Delusions	Bizarre behavior	positive FTD
corpus-based WF SF	$r_s = -.134$ $p = .435$	$r_s = -.249$ $p = .142$	$r_s = -.189$ $p = .270$	$r_s = -.137$ $p = .425$	$r_s = -.003$ $p = .985$
within-sample WF SF	<b><math>r_s = -.348</math></b> <b><math>p = .038^*</math></b>	$r_s = -.190$ $p = .268$	<b><math>r_s = -.391</math></b> <b><math>p = .018^*</math></b>	<b><math>r_s = -.332</math></b> <b><math>p = .048^*</math></b>	$r_s = -.221$ $p = .194$
corpus-based WF LF	$r_s = .257$ $p = .131$	$r_s = .017$ $p = .922$	$r_s = .302$ $p = .073$	$r_s = -.015$ $p = .932$	$r_s = .174$ $p = .309$
within-sample WF LF	$r_s = .184$ $p = .284$	$r_s = -.207$ $p = .225$	$r_s = .032$ $p = .854$	<b><math>r_s = .339</math></b> <b><math>p = .043^*</math></b>	$r_s = .215$ $p = .209$

# RESULTS & DISCUSSION

## Correlational analyses

- Significant correlations were observed only with the two within-sample WF variables
- Previous research has only found that disorganization symptoms are associated with VF performance (Robert et al., 1998; Veleva et al., 2019)
- Disproportionate correlational directions across the SF and LF within-sample WFs
  - A distinct pattern of word frequency effects on SF and LF in patients with schizophrenia in association with bizarre behavior

# LIMITATIONS

- We had no group of healthy subjects for comparison
- Corpus-based and within-sample WFs differ in the sense that corpus-based WF is extracted from data on real language use in a presumably representative sample of speakers of a given language, while within-sample WF was calculated in our study from data of a behavior (i.e., VF) that is typically not observed during natural communication and using an unrepresentative sample of speakers of the given language
- We did not control for multiple comparisons in our correlational analyses

# THANK YOU FOR YOUR ATTENTION

Preprint available at: *PsyArXiv* (doi: [10.31234/osf.io/7tndz](https://doi.org/10.31234/osf.io/7tndz))

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