

mocha
dynamic learner behaviour
in icall

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second language
acquisition studies

construction grammar

mocha project

dynamic systems
theory

icall

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grau, mein treuer freund ist alle theorie

- dynamic systems theory (katok & hasselblatt, 1997) and chaos theory (gleick, 1983; lorenz, 1993; williams, 1997)
- second language acquisition theory (de bot et al., 2005, 2007; ellis & larsen-freeman, 2006; larsen-freeman, 1997; larsen-freeman & cameron, 2008)

und grün des lebens goldner baum

- **nonlinear** (Lorenz, 1993, pp. 161-163), i.e., it incorporates spurts, progression, plateaus, fossilization, and retrogression, ...;
- **nonperiodic**, i.e., segments of the language learning process will not be repeated and will not recur;
- **nonmonotonic**, i.e., the speed of L2 acquisition and / or attrition varies over time;
- **fractal** (Lorenz, 1993, pp. 168-179), i.e., smaller segments of the system or the system's development are self-similar to larger ones.
- **complex** (Lorenz, 1993, pp. 163-168), i.e., a large number of variables will have to be considered at any given point in time, their dialectic interactions have to be taken into account as well as the changes they undergo through the interaction with other variables and over time.
- **sensitive to initial conditions**, i.e. even tiny differences in these initial conditions often result in large differences in the end state of the system due to the complex nature of the dynamic system.

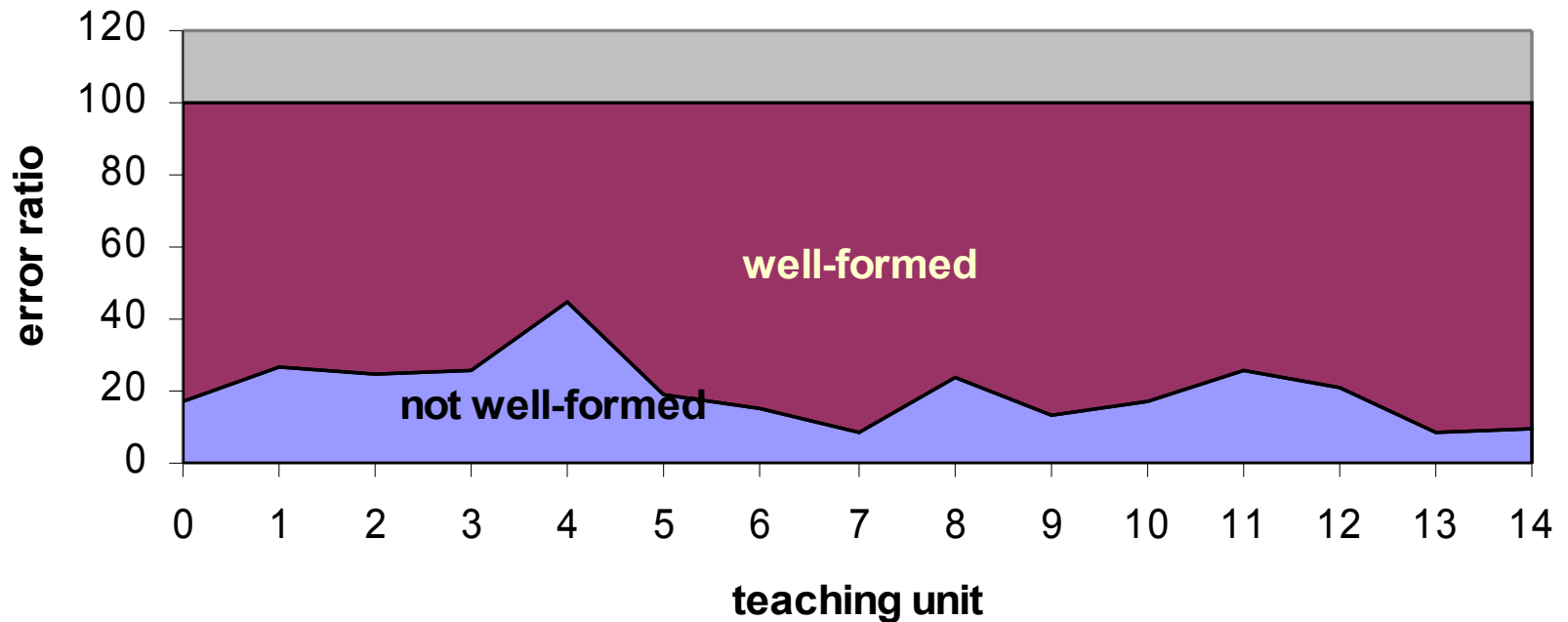
student: sarah:

build-a-sentence activity

| semester | chapter | gramm. phenomena in deutsch na klar! |
|-------------------|---------------------|--|
| fall '04 | introduction | basic sentences (SV, SVO) |
| fall '04 | chapter 1 | basic sentences and questions |
| fall '04 | chapter 2 | negation |
| fall '04 | chapter 3 | accusative case |
| fall '04 | chapter 4 | separable prefixes |
| spring '05 | chapter 5 | dative case, wo-wohin-woher |
| spring '05 | chapter 6 | modals |
| spring '05 | chapter 7 | coordinating conjunctions |
| spring '05 | chapter 8 | subordinating conjunctions |
| spring '05 | chapter 9 | genitive case |
| fall '05 | chapter 10 | comparatives, past perfect |
| fall '05 | chapter 11 | relative clauses, future tense, nicht |
| fall '05 | chapter 12 | subjunctive, da-wo-compounds |
| fall '05 | chapter 13 | subjunctive, infinitive clauses |
| fall '05 | chapter 14 | passive voice |

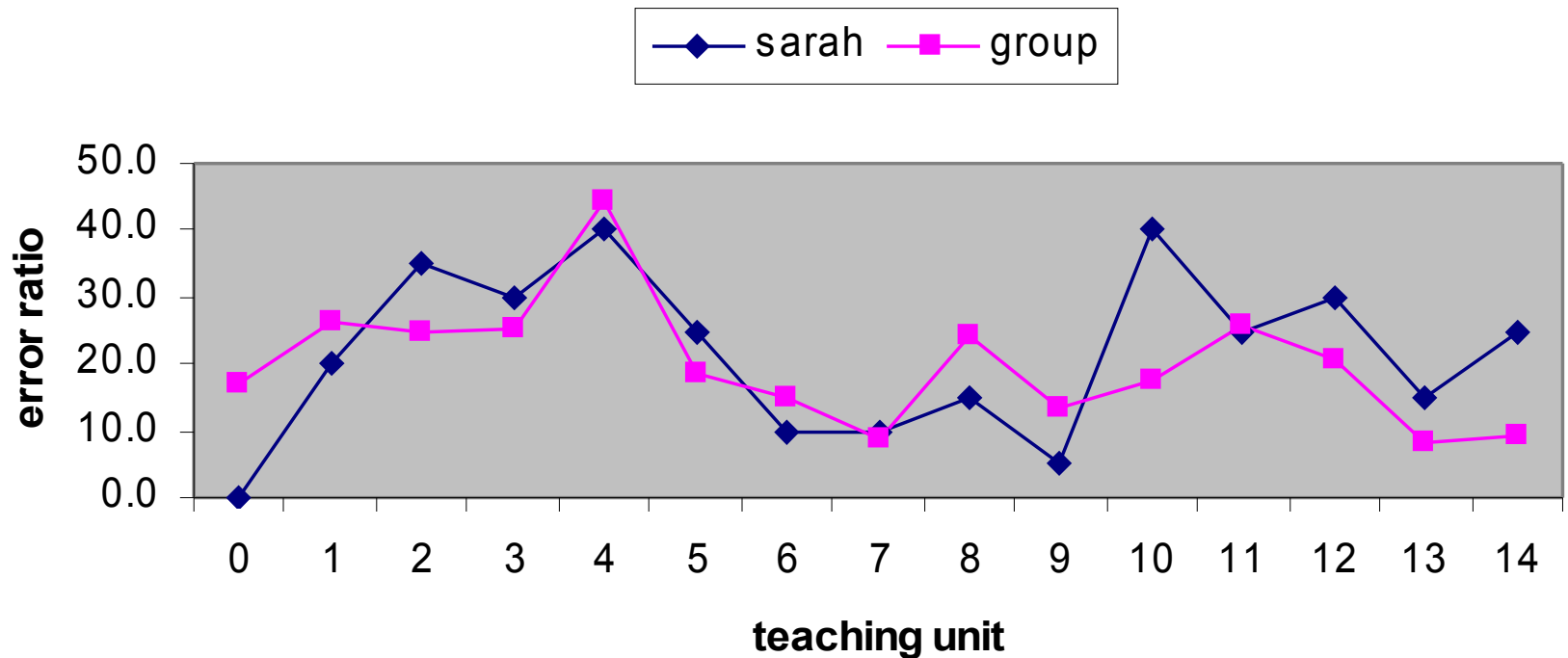
group average word order performance

4420 students

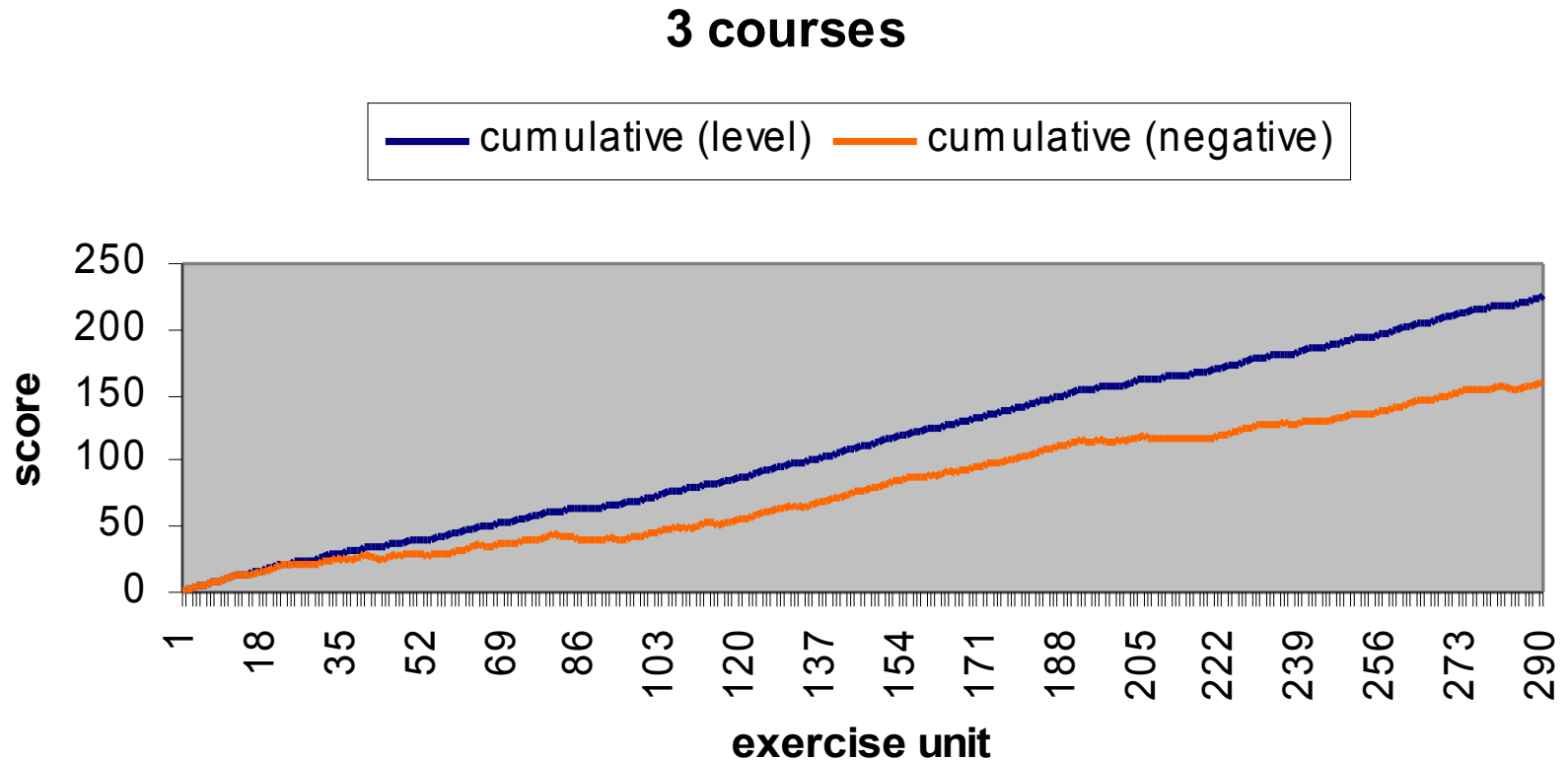


sarah as a member of her group

word order deviations (%)



sarah's cumulative scores



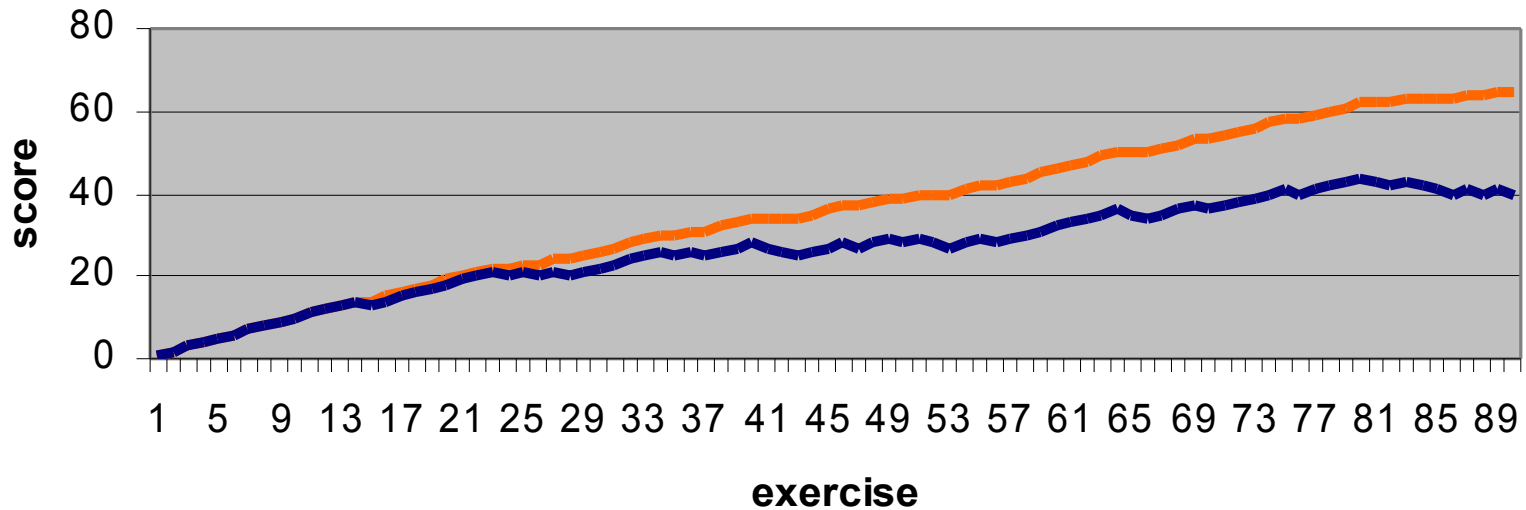
cumulative (level): correct response = 1 incorrect = 0

cumulative (negative): correct response = 1 incorrect = -1

sarah's cumulative scores

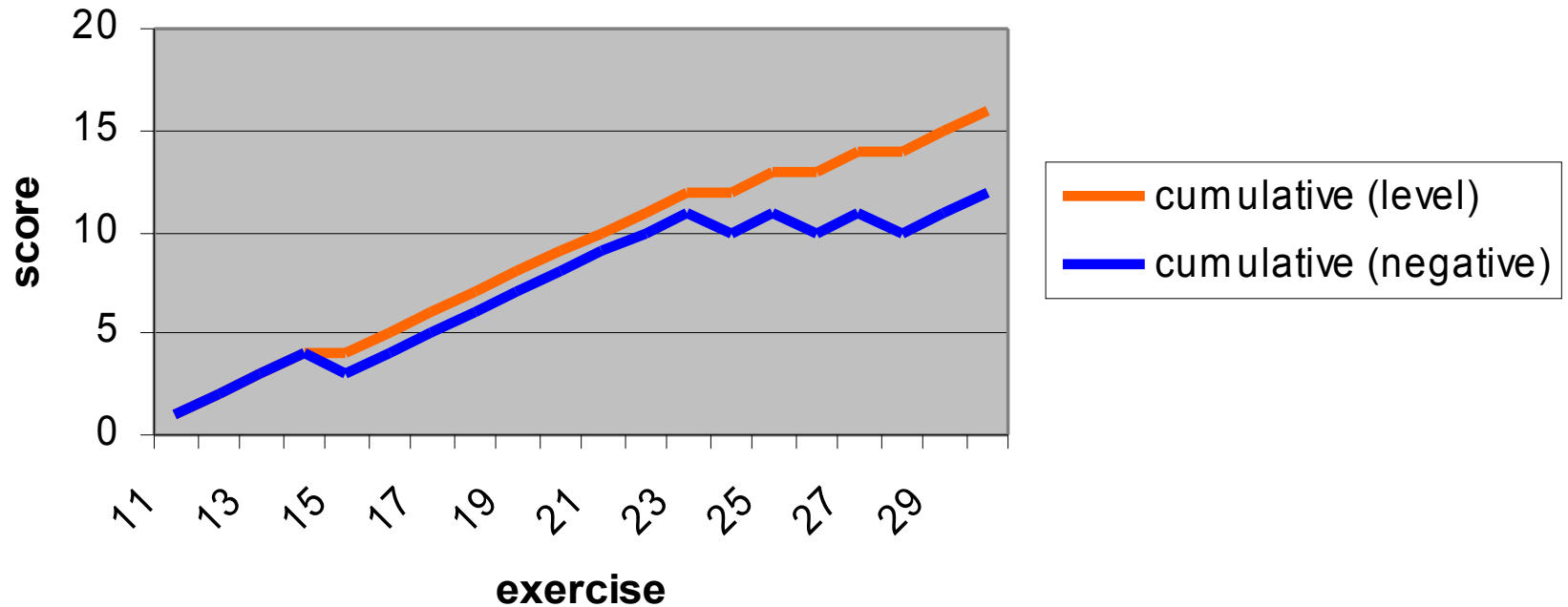
one semester

— cumulative (level) — cumulative (negative)



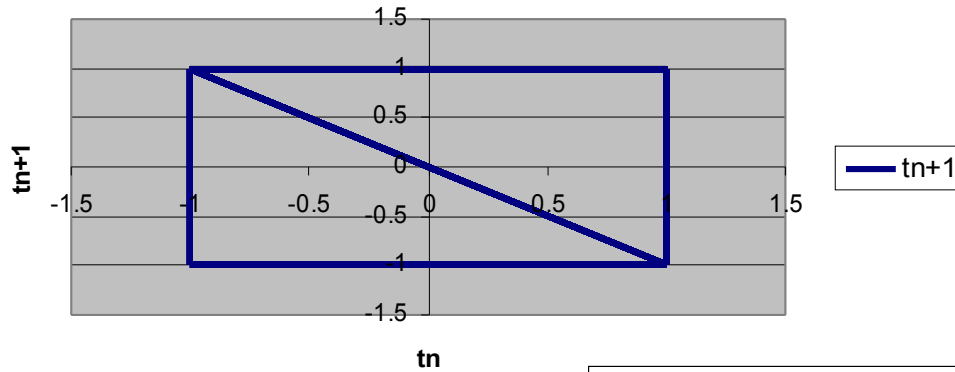
sarah's cumulative scores

one chapter

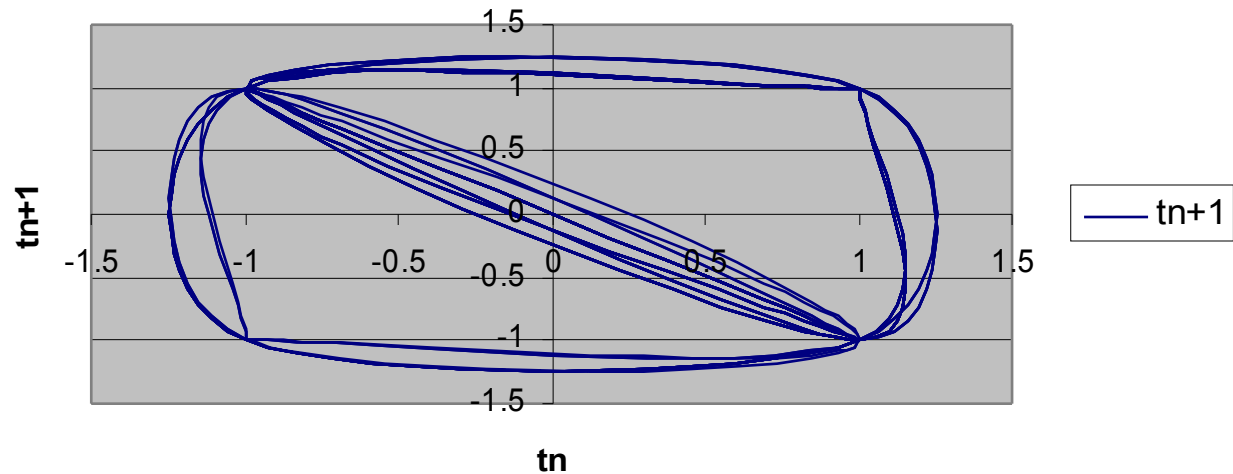


sarah's scores in a phase space diagram

score phase space (not smoothed)



score phase space (smoothed)



estimating sarah's performance scores

- **if** $t_n = t_{n+1}$ **then** $i_{n+1} = i_n + \text{sqrt}(i_n)$ **else** $i_{n+1} = \text{sqrt}(i_n)$
- **if** $t_{n+1} = 1$ **then** $p_{n+1} = p_n + i_{n+1}$ **else** $p_{n+1} = p_n - i_{n+1}$
- $-100 \leq p_{n+1} \leq 100$

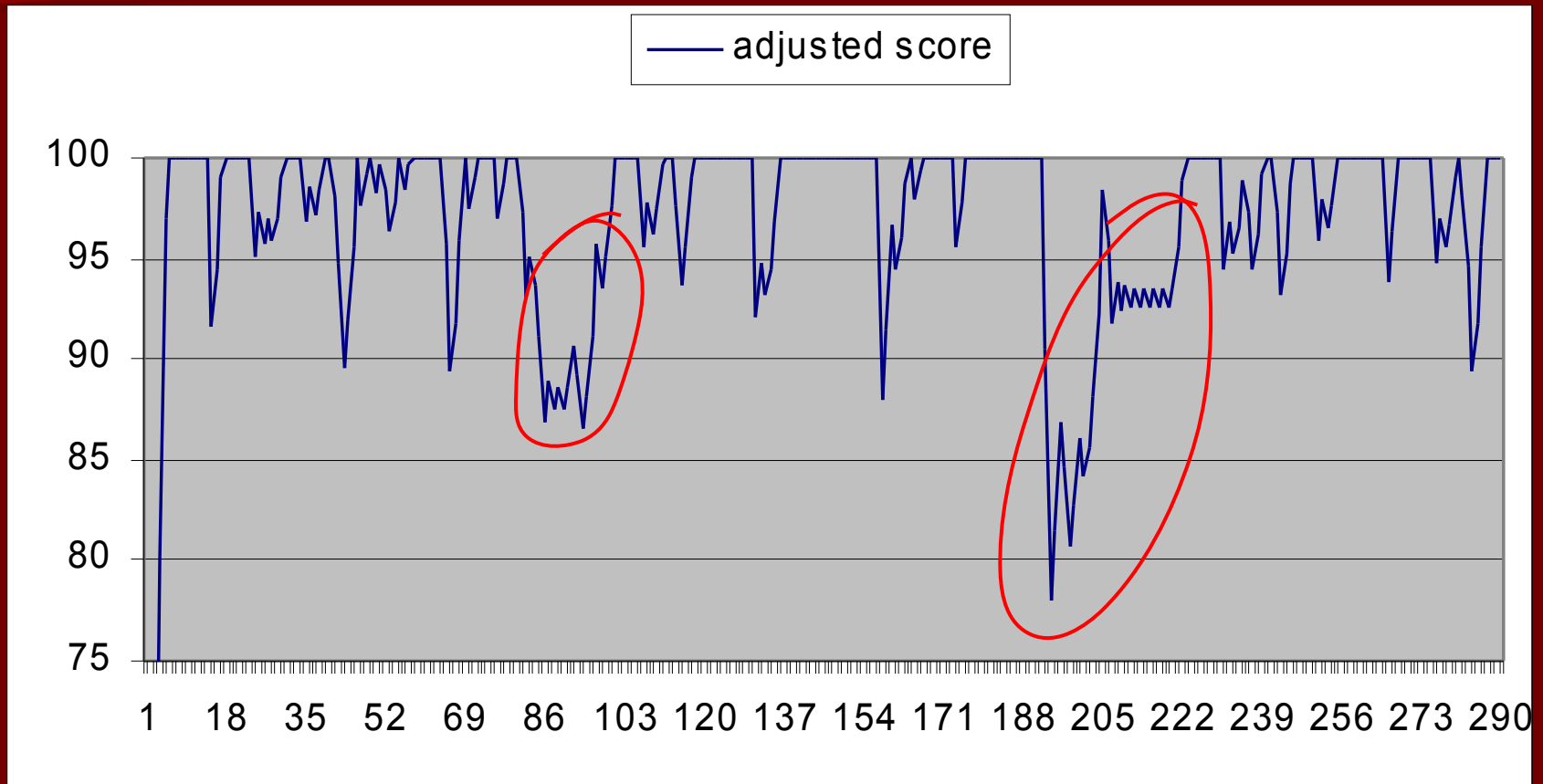
t – score at time t

i – increment at time t

p – estimated performance at time t

increments increase for consistently positive or negative scores, highlighting consistent strengths or weaknesses, thus scores are adjusted based on context

sarah's adjusted performance indicators



tentative results

- sarah has acquired the different facets of german word order in the course of her three semesters
- with very few exceptions and bar a few lapses, sarah performs consistently well
- her word order performance decreases when separable-prefix verbs are introduced and at the beginning of her third semester when comparison and past perfect are introduced
- it is at these times when an instructional intervention would be useful for her

conclusion

- binary score data even for individual phenomena is too coarse for a meaningful interpretation
- estimating performance on an individual variable over time (in temporal context) provides some insight
- multivariate analysis is necessary to capture the complexity and dynamics of the language learning process, but data collection and structuring is time-consuming and the analysis is difficult – we are only at the beginning