UDK 159.953:80
165.74: 80
Izvorni znanstveni rad

Prihvaćeno 20.06.1999.

John Fox
Faculty of Hotel Management Opatija, Opatija
Croatia

ANALYSING ELICITED RESPONSES TO "WHEN" QUESTIONS TO RESEARCH PERCEPTION OF FUTURE TIME

SUMMARY

Trends in psycholinguistics have reflected an awareness that the finer aspects of cognitive processing may be sensitive to contextual factors. Investigating how contextualisation conventions work provides insight into such processes. Analysing elicited responses to when "kada?" questions for an event set at varying temporal distances in the future, this paper investigates how Croatians perceive future time. Responses are analysed within the contextualisation convention finer-grained vs coarser-grained information. Results confirm the importance of the deictic expression (coarser grained information) for these processes. This suggests understanding the deictic expression as a frame which, by definition, would represent our optimum perception of future time. An exception to the use of the deictic expression - 10 days, is explained as a cultural stimulus identification. This research is especially relevant to human-computer interface design and understanding and explaining knowledge acquisition.

Key words: *cognitive processes, contextualisation, deixis, knowledge acquisition*

INTRODUCTION

Asking questions and giving answers are important for many recurring activities and communicative tasks in our lives such as explaining, arguing, emphasising, instructing, directing. Crucial to the success of these exchanges are communicators' **shared expectations** negotiated as part of the interaction itself and made possible through **contextualization conventions** -- communicative strategies which are seen to operate systematically within specific communicative traditions (Gumperz, 1990:18).

Acquired as a result of a speaker's actual interactive experience, i.e. as a result of an individual's participation in particular networks of relationship, contextualisation conventions foster a co-operative exchange of information between participants. Like grammatical knowledge, they operate below the level of conscious. They reflect necessary human cognitive and perceptive constraints (e.g., trade-off of indeterminacy vs determinacy to enable control over a domain) (De Beaugrande, 1997:90); linguistic constraints (e.g., phonemic coding and distinctive features) (Lindblom, 1984:213); and social constraints (e.g., T/V distinction found in many languages; adjacency pairs: Thanks. You're welcome.) (Mey, 1993; Yule, 1996). They are proof of an on-going dynamic dialect between an **experienced world** and a person's **world-model,** where the world provides experiences which constrain the world model, and the world model offers knowledge contexts to make sense of experiences (De Beaugrande, 1997:86). Where networks of relationships differ, as in ethnically mixed settings, conventions may also differ and communication may become disrupt.

Recent trends in psycholinguistics reflect an increasing awareness that contextual factors may influence the finer aspects of cognitive processing (Gernsbacher, 1994; Dijkstra & deSmedt, 1996; Bruce, 1996). The need for research in this area has been underpinned by Dijkstra (1998). Namely, theoretical frameworks are needed that relate and integrate notions on stimulus identification with task demands, subject strategies and resource use.

PAPER SUBJECT

A good example of a contextual convention, or better said, cognitive constraint of communication (De Beaugrande, 1997: 78-180), is treating some data more fine-grained and other coarse-grained. The use of grain size constrains determinacy of reference, supporting either more determinate (fine-grained), or more indeterminate (coarse-grained) communication. This constraint is typically used in temporal reference for answering "when" questions for future events. Consider the following responses:

1. *At 5:00 AM.*
2. *Tomorrow.*
3. *Soon.*

4. *On November 23.*
5. *Next week.*
6. *In a couple of days.*
7. *This year.*

All responses are technically acceptable, yet vary in specificity, informativeness, grain size and relevance to the questioner's goal. The grain size of Answers 1 and 4 are finer-grained than the coarser-grained Answers 5 and 6. The accepted use of certain answers for certain situations (e.g., *Tomorrow.*) suggests the presence of contextualisation conventions.

Using elicited responses to "when questions" for a future event, this paper researches the constraint of communication **fine-grained vs coarse-grained** data as a **design parameter** of human cognitive processing. Particularly, the paper aims towards a better understanding of our perception of future time. Research is restricted to the Croatian language use of when question -- "kada?".

PREVIOUS RESEARCH

Research closest to this paper is mostly on how people understand the distal expression "then" referring to both the past and future time relative to the speaker's present time.

Two types of expression are used to indicate time: deictic (yesterday, tomorrow, next week) and non-deictic (calendar time, dates and clock time). What is essential to all such expressions is knowing the relevant utterance time.

Such research concerns one of the major cognitive abilities of human beings: the ability to project concepts onto other concepts (present onto future and past). It has been ideally demonstrated in Lakoff and Johnson's (1980) cognitive theory of metaphor and metonym.

There would seem to be a similar psychological basis for temporal dexis to spatial dexis (Yule, 1996). Temporal events can be treated as objects that are moving towards us (or away from us): *the coming week // tjedan koji dolazi, the past week // prošlog tjedna*. Also, the choice of verb tense can be used as a temporal dexis. The present tense is the proximal form [3] and the past [4] is the distal:

I live in Croatia now. // Sada živim u Hrvatskoj. [3]
I lived in Croatia. // Živio sam u Hrvatskoj. [4]

For if-clause events (Green, 1989), the past tense is always used in English to mark an event as not being close to the speaker [5] (Croatian language does not have this possibility), which highlights how our perception of time is grounded in language:

If I were a millionaire. // Da sam bogat. [5]

Research on psychological processes on how individuals answer "when" questions has been mostly confined to the perception of time and memory for time duration. Studies have demonstrated:

(a) Time measurement devices (calendars, clocks) do allow humans to understand time beyond the biological horizons of the body (Fraser, 1987).
(b) How individuals extract temporal information when they attempt to remember past events (Friedman and Wilkins, 1985; Michon, 1986). This method has also been used to investigate the development of memory and conceptual development in children (Friedman & Wilkins, 1985). In a similar way, relational language terms such as *before* and *after* (French, 1989) have also been investigated.
(d) Models of question-answering which specify the knowledge structures which supply answers to questions and the procedures that select appropriate answers from these structures (Ziegler *et al.*, 1997). Such models discuss the use of the answerer's search of script structures, planning structures and causal chain representations.
(e) Procedures used in generating answers to "when" questions (in English) linked to the number of days of the future event away from the present (Golding *et al.*, 1992:213-227). For instance, the probability that people generate the exact clock time was linked to a future event of up to 3 days from the present event. Beyond that the probability of clock time being given is greatly reduced.

All of these studies have emphasised:

- answering questions to future (and past) events is neither a simple task, nor a random one
- much more research is needed to formulate an understanding of our perception of time, both past and future
- language is a conspicuous medium for such research.

WORKING HYPOTHESES

Functionally, an elicited response may be thought of as a manifestation of a set of interconnected design parameters: (a) the questioner's goals; (b) the answerer's goals; (c) its design as a product of our perception of time; and (d) a random stimulus, e.g. cultural influence. Design parameters determine which means will serve which ends. The **precedence** of a design parameter (e.g. requesting the exact date, day and time) influences the response. To investigate **perception of time** as a design parameter, the elicited response was treated as an **independent variable** and the event setting as a **dependent variable,** and the following research hypotheses accordingly set:

H_0 : Elicited responses to "kada" questions are arbitrary.
H_1 : Elicited responses to "kada" questions are not arbitrary.

METHOD

255 first year students of the *Faculty of hotel management Opatija*, Croatia took part in this study.

The method and procedure used was an application of Golding *et al.* (1992) consisting of scenarios describing an every day situation in which an event setting was situated from a present setting for given temporal durations. Accompanying the scenario was a description of a situation and a "when" question (Table 1):

Table1. A "when" question scenario
Tablica 1. Scenarij pitanja "kada"

Scenario	
Present setting	
Location	Faculty
Day of the week	Tuesday
Date and time	November 3, 1998, 9:00 A.M.
Event setting	
Event	Seminar presentation
Location	Faculty, room 3
Day of the week	Tuesday
Date and time.	November 3, 1998, 10:00 A.M
Situation and question	
You have to present a seminar work (event setting). Your friend asks you when are you going to present your seminar. Answer (orally) as naturally as you would in real life. Now write down your answer.	
Answer:	

Fifteen scenarios each with a different temporal duration were randomly presented to students. The event settings were centred around the very near future: 2, 3, 4, 7, 10, 18 days on - same month as present setting, reasonably near future: 30, 31, 35, 43, 48, 52 days on - following month; and distant future: 120, 365 days on. Students were asked to write down real-life spontaneous answers to all of the 15 scenarios. Elicited responses were summarised and statistically analysed to test H_o.

RESULTS AND ANALYSIS

Six types of elicited responses $X = (x_i)$ were given to the event setting $Y = (y_i)$, where y_i is the number of days of the event setting from the present setting. They consisted of:

x_1 = day, date and time *(Tuesday, November 3, 1998, 10:00 A.M.)*
x_2 = date and time *(November 3, 1998, 10:00 A.M.)*
x_3 = date *(November 3, 1998.)*
x_4 = deictic expression and time *(Next week at 10:00 A.M.)*
x_5 = deictic expression *(Next week.)*
x_6 = number of days *(Ten.)*

Frequencies for each x_i were summed-up for each of the 15 scenarios $(y_1, y_2, ..., y_{15})$, and converted into a probability table (Table 2) where $P(y_i) = \sum x_j = 1$.

Table 2. Probabilities for different types of answers for "when" scenarios
Tablica 2. Vjerojatnost različitih tipova odgovora na pitanja "kada"

X / Y	x_1 (day,date,time) (dan,datum, vrijeme)	x_2 (date, time) (datum,vrijeme)	x_3 (date) (datum)	x_4 (deictic ,time) (deiksa,vrijeme)	x_5 (deictic) (deiksa)	x_6 (no. of days) (br. dana)
y_1 (1)	0.12	0	0.02	0.24	0.62	0
y_2 (7)	0.10	0	0.10	0.12	0.61	0.07
y_3 (30)	0.07	0.07	0.20	0.03	0.63	0
y_4 (120)	0.12	0.07	0.22	0.07	0.52	0
y_5 (365)	0.10	0.05	0	0	0.83	0.02
y_6 (2)	0.07	0.07	0	0.08	0.44	0.34
y_7 (3)	0.05	0.12	0	0.02	0.27	0.54
y_8 (4)	0	0.15	0.02	0	0.49	0.34
y_9 (10)	0	0.15	0.02	0.02	0.05	0.76
y_{10} (18)	0	0.19	0.12	0	0.54	0.15
y_{11} (48)	0.07	0.15	0.15	0.07	0.49	0.07
y_{12} (31)	0	0.07	0.12	0.12	0.62	0.07
y_{13} (35)	0.15	0.20	0.07	0.51	0.05	0.02
y_{14} (43)	0	0.17	0.17	0.13	0.51	0.02
y_{15} (52)	0.07	0.08	0.17	0.17	0.49	0.02

To test the hypotheses H_o / H_a, the first order model [6]:

$$y_i = ß_0 + x_1ß_1 + + x_2ß_2 + x_3ß_3 + x_4ß_4 + x_5ß_5 + x_6ß_6 + E, \quad [6]$$

where:

$\mathbf{H_O}$: $ß_1 = ß_2 = ... = ß_k = 0$ (all model terms are unimportant for predicting y_i)

$\mathbf{H_a}$: at least one $ß_i \neq 0$ (at least one model term is useful for predicting y_i)

was fitted to the data in Table 2, and the least squares prediction equation model [7] obtained (SPSS multiple regression):

$$\hat{Y} = 182.22 + 12.01x_1 + 0.16\ x_2 - 11.57\ x_3 - 19.34x_4 - 7.25x_6 \quad [7]$$

The value of the adjusted *R square* was 0.23877 which **rejected $\mathbf{H_O}$**. To test the significance of this result, an *F*-test was done (F = 1.878: $\langle$ 3.58, α = 0.025) which confirmed the rejection of $\mathbf{H_O}$ and acceptance of $\mathbf{H_a}$.

Consequently, a simple linear regression model was fitted between Y and each individual x_i separately [8], and the hypothesis: at least one $ß_i \neq 0$, tested.

$$Y = ß_0 + ß_j\ x_j + E,\ j=1,2, ..., 6 \quad [8]$$

orrelation was significant for x_5 (deictic expression) (0.537: $\alpha = 0.05$; 2-tailed) only (Table 3).

Table 3. Correlation between y and each x_j
Tablica 3. Veza izmedu y i svakog x_j

X	x_1	x_2	x_3	x_4	x_5	x_6
Y	338	-.207	-.079	-.262	.537	-.317

INTERPRETATION AND EXPLANATION

Multiple regression analysis supported the rejection of the working hypothesis H_o (answers to a when question are arbitrary), and acceptance of the alternative hypothesis H_a (answers to when questions are not arbitrary). Further testing the correlation between Y and each individual x_i separately confirmed the deictic expression (X_5) as the only statistically significant answer which can be used to predict Y, i.e., the only answer which **precedes** the question.

The significance of the deictic expression strongly supports a "when answer" schema -- mental devices or networks (patterns) that individuals may

construct or adapt on the spot from higher level structures while performing a particular task in order to achieve a specific task, and not simply structures in long-term memory (Schank, 1982, 1985; Barsalou, 1987).

For a schema to regulate behaviour and knowledge, individuals must maintain the task as a goal (otherwise, other schema elicited by the stimulus may produce task-irrelevant behaviour). The task schema, a pre-existing knowledge structure, would regulate the lexico-semantic system by altering the activation levels of representation (answers of different grain size) within that system and by inhibiting outputs from the system, for example, the non-deictic expression. It would remain active until (a) the goal is achieved, or (b) it is actively inhibited by another schema, or (c) a new goal is defined.

Representing a commonly shared schema of a fixed static pattern, sometimes called a frame, the deictic expression would, by definition, reflect optimum human perceptive abilities (pre-existing knowledge structure) of future time.

In his state space semantics Churchland (1991) has suggested the basic idea that the brain represents various aspects of reality by a position in a suitable state space, and the brain performs computations on such representations by means of general co-ordinate transformations from one state to another. The use of the deictic expression would facilitate such a system, by simplifying the complexity of numerous computations. (e.g., 24 hours ⇒ Tomorrow.).

Finally, within the context of our research, we need to explain the interesting precedence of use for the event setting y_9 (*10 days*). According to our model, we explain this as a result of a **random design parameter**, or stimulus identification (Dijkstra 1998), probably due to the inherent cultural value of the number 10. Further cross-cultural research will show whether such design parameters do influence cognitive processing (e.g., a similar result might be found for the number 12 - a dozen, in Great Britain).

CONCLUDING REMARK

Using "when" question elicited responses about a future event demonstrated the powerful potential of this method for researching human cognitive processes. Research supports the need to understand contextual conventions as design parameters which allow trade-off enabling control over information to be achieved. Results indicate too, that students are capable of putting themselves in a hypothetical role of a conversational participant and providing elicited responses to "when" questions based on their knowledge of the temporal duration between a present setting and an event setting.

The approach used in this research is an advance over previous similar models (Golding *et al.*, 1992). Namely, understanding the elicited response to consist of design parameters, **bracketing of content to highlight design**, allowed a wider research application. We believe this methodology can be effectively used in future similar research.

Research results support recognising the importance of contextual factors on cognitive processing. Applied to information systems (e.g., automated telling machines), our research suggests that fine-grained information can not be a sole criterion of interface. The top goal of user-friendliness, making interaction with computers more rewarding and satisfying, could be better achieved through an increased use of coarser-grained information preceding fine- grained. This conclusion could be usefully applied to other cognitive learning processes (e.g., foreign language learning). Our research has highlighted too the important influence of random design parameters, notably cultural, on contextual conventions.

Dealing with the methodological and conceptual issues presented in this paper will take time, work and some inventiveness. Cross cultural research is necessary to provide the necessary background knowledge on how constraints are used as universals. Above all, this research clearly demonstrates the importance of understanding "knowledge acquisition as less a process of procuring the goods than it is often an occasion for composing them" (LaFrance, 1992:1126).

REFERENCES

Barsalou, L. (1987). The instability of graded structure: Implications for the nature of concepts. In U. Neisser (ed.), *Concepts and conceptual development: Ecological and intellectual factors in categorization*, 101-104. Cambridge: CUP.

Bruce, V. (1996). (eds.) *Unsolved mysteries of the mind: Tutorial essays on cognition.* England: Taylor & Francis.

Churchland, P. M. (1991). *A Neurocomputational Perspective: The Nature of Mind and the Structure of Science*. Cambridge, Mass: MIT Press.

De Beaugrande, R. (1997). *New Foundations for a Science of Text and Discourse.* Norwood: Ablex Publishing Corp.

Dijkstra, A. (1998). "From tag to task: Coming to grips with bilingual control issues". *Bilingualism*, **1**, 88-90.

Dijkstra, A. & de Smedt, K. (1996). *Computational psycholinguistics: AI and connectionist models of human language processing.* London: Taylor and Francis.

Fraser, J. T. (1987). *Time the familiar stranger*. Amherst, M.A.: UMP.

French, L. A., (1989). Young children's responses to "when" questions: Issues of directionality. *Child Development*, **60**, 225-236.

Friedman, W. J. & Wilkins, A. (1985). Scale effects in memory for the time of events. *Memory and Cognition*, **13**, 168-175.

Gernsbacher, M. A. (1994). (ed.) *Handbook of psycholinguistics*, San Diego: Academic Press.

Green, G. (1989). *Pragmatics and Natural Language Understanding*. Lawrence Erlbaum.

Golding, J. M., Magliano, J. & Hemphill, D. (1992). WHEN: A model for Answering "When" Questions About Future Events. In Lauer, T. W., Peacock, E., and Graesser, A. C. (eds.) *Questions and Information System.* London: Lawrence Erlbaum Assc. Pub.

Gumperz, J. J. (1990). *Language and social identity.* Cambridge: CUP.

Lackoff, G. & Johnson, M. (1980). *Metaphors We Live By.* Chicago: UCP

LaFrance, M. (1992). Questioning Knowledge Acquisition. In Lauer, T. W., Peacock, E., and Graesser, A. C. (eds.) *Questions and Information Systems.* London: Lawrence Erlbaum Assc. Pub.

Lindblom, B. P., et. al. (1984). Self-organising processes and the explanation of phonological universals. In B. Butterworth, B. Crombie and O. Dahl (eds.), *Explanations for Language Universals.* New York: Mouton.

Mey, J. (1993). *Pragmatics: An Introduction.* Blackwell.

Michon, J. A., & Jackson, J. L. (1986). *Time, mind and behaviour.* New York: Springer-Verlag.

Schank, R. C. (1982). *Dynamic Memory*: A *Theory of Reminding and Learning in Computers and People.* Cambridge: CUP.

Schank, R. C. (1985). Reminding and memory organisation. In A. M. Aitkenhead & J. M. Slack (eds.) *Issues in cognitive modeling*, 229-249. Hillsdale, NJ: Lawrence Erlbaum.

Yule, G. (1996). *Pragmatics.* Oxford: OUP.

Ziegler, J. C., Besson, M., Jacobs, A. M., Nazir, T. A., & Carr, T. H. (1997). Word, pseudoword and nonword processing: A mulitask comparison using event-related potentials. *Journal of Cognitive Neuroscience*, 9(6), 758-775.

John Fox
Hotelijerski fakultet Opatija, Opatija
Hrvatska

ISTRAŽIVANJE PERCEPCIJE BUDUĆEG VREMENA ANALIZOM ODGOVORA NA PITANJA "KADA?"

SAŽETAK

U radu je opisano istraživanje jednog kontekstualnog čimbenika, fine nasuprot gruboj vremenskoj referenciji u odgovorima na pitanja sa "kada", koja se odnose na buduće događaje.

Istraživanje je ograničeno na hrvatski jezik, a postavljena su dva istraživačka pitanja:

- *Kako se odabire prikladan odgovor na pitanje sa "kada"?*
- *Koriste li se postupci i mogu li se oni opisati?*

Tema istraživanja najbližeg ovom radu jest razumijevanje distalnog izraza "tada", koji se odnosi na prošlo i buduće vrijeme, a u vezi je sa sadašnjim vremenom govornika. Istraživanje psiholoških procesa u odgovorima na pitanja sa "kada" ograničeno je na percepciju vremena.

Radne hipoteze:
H_0 = *odgovori na pitanja sa "kada" jesu arbitrarni*
H_a = *odgovori na pitanja sa "kada" nisu arbitrarni*

Metoda i postupak predstavljaju primjenu istraživanja što su ga proveli Golding et al. (1991), koje se sastoji od scenarija što opisuju svakodnevnu situaciju u kojoj je neki događaj na određeno vrijeme povezan sa sadašnjošću.

Na temelju analize višestruke regresije odbijena je hipoteza H_0 i prihvaćena je alternativna hipoteza H_a.

Daljnje testiranje korelacije između Y i svakog pojedinačnog X dovelo je do postavljanja nove hipoteze H_{01}: odgovori na pitanja sa "kada" predvidivi su za diektični izraz (npr. idućeg tjedna) kao jedini statistički značajan odgovor koji se može koristiti za predviđanje Y.

Važnost diektičnog izraza podupire shemu odgovora sa "kada". Churcland (1991) izrazio je ideju da mozak predstavlja različite aspekte realnosti položajem u odgovarajućem prostoru. Uporaba diektičnog izraza olakšala bi takav sustav kroz eksponencijalnu simplifikaciju kompleksnosti brojnih izračuna.

Rezultati istraživanja upućuju na to da je stjecanje znanja manje proces dobave materijala, a više proces slaganja (La France, 1992). Istraživanje se može primijeniti u pragmatici učenja stranog jezika, u rehabilitaciji govora i u lingvistici.

Ključne riječi: *kognitivni procesi, kontekstualizacija, deikse, usvajanje znanja*