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Cultural differences in dynamic decision-making strategies in a non-linear, time-delayed task

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Abstract

People in every culture must deal with time and the uncertainties of the future. This study investigates how people in five countries make decisions in the dynamic simulation COLDSTORE with its non-linear time development (Reichert & Dörner, 1988). We expected that, (1) as in the original study (Reichert, 1986), only 20% of all participants would deal adequately with the simulation; (2) an adapting, cautious decision-making strategy would be most successful, and an extreme oscillating decision-making strategy least successful; and (3) based on cultural differences in pace of life and time orientation, German and US participants would show adaptor-type decision making more often and Indian, Filipino, and Brazilian participants would show oscillator-type decision making more often. Controlling for age, gender, computer experience, and intelligence, results confirmed all hypotheses. Performance and strategies were further analyzed regarding participants' reflections about their own procedure and simulation characteristics. The cross-cultural differences in dynamic decision-making strategies found in this study highlight the cultural embeddedness of people's cognitive processes.

Keywords: Cross-cultural differences; Culture; Non-linear time; Time orientation; Planning; Dynamic decision making; Strategy; Intelligence; Performance; Complex problem solving

1. Introduction

Previous research on complex problem solving (CPS) and dynamic decision making (DDM) – we use these terms interchangeably – has been conducted mainly in western-industrialized countries, primarily by applying computer simulations of complex problems, also called microworlds (Brehmer & Dörner, 1993), as research instruments. These microworlds can be characterized as complex (large numbers of interconnected variables and possible operators), dynamic (changing over time), and non-transparent (lack of clarity of the situation, the variables, and the dynamics; e.g., Dörner, 1996; Güss, 2000). CPS and DDM can be defined as overcoming barriers between a given state and goal states by means of multi-step activities involving the person's "cognitive, emotional, personal, and social abilities and knowledge" (Frensch & Funke, 1995b, p. 18).

Over the last 30 years, a wealth of research in this field has been accumulated (Frensch & Funke, 1995a). Specifically, individual difference variables such as intelligence (e.g., Rigas & Brehmer, 1999; Wenke, Frensch, & Funke, 2005) or gender (Schaub, 2001) and their influence on performance have been investigated. Recently, researchers recommended investigating not only individual difference variables, but also the process people engage in while solving complex problems and making dynamic decisions, as well as what strategies they use (Schoppek & Putz-Osterloh, 2003). Thus, our focus in this study will be on the strategies participants use to deal with a microworld.

Due to possible limitations associated with psychological research solely conducted in western-industrialized

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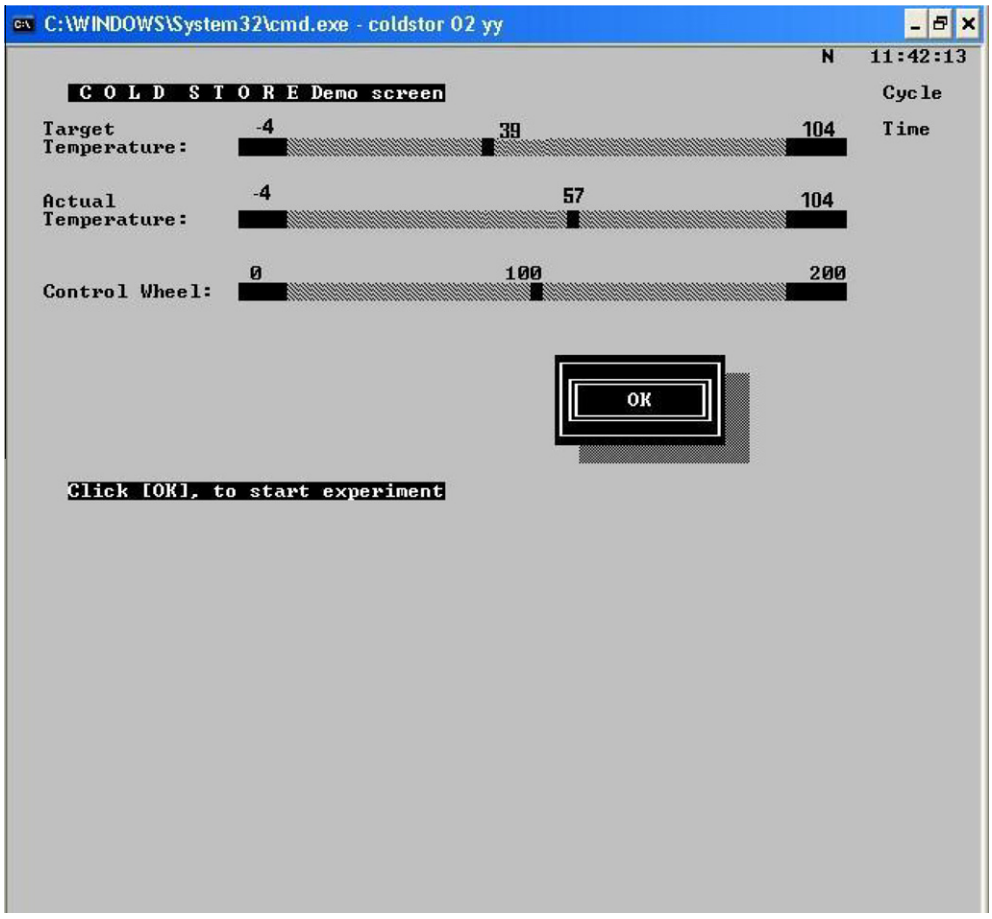

Fig. 1. Screenshot of the COLDSTORE simulation. The target temperature always remains on 39 °F (4 °C in the version for the other countries). The actual temperature changes depending on the changes participants make on the control wheel.

countries, our second focus will be on possible cultural differences in CPS and DDM strategies. Do people from different cultures use different strategies in solving the same problem? Surprisingly, the study of how culture influences problem solving and decision making has not received much attention (Weber & Hsee, 2000). Only recently has there been exploration into cultural influences on CPS and DDM, which showed, indeed, cultural differences in decisions made (e.g., Strohschneider, 2001; Strohschneider & Güss, 1999) and in strategies as expressed in thinking-aloud protocols (Güss, Tuason, & Gerhard, 2010). This article extends the research on cultural influences on DDM, focusing on the role of participants' strategies in DDM and their possible cultural embeddedness. Our theoretical assumption is that culture, as represented in a person's mind, is the framework from within which specific CPS and DDM strategies are selected and executed.

2. The COLDSTORE simulation and its demands

The current study investigates cultural differences in the COLDSTORE simulation (Reichert & Dörner, 1988, following McKinnon & Wearing, 1985). COLDSTORE simulates a small supermarket with a storage full of dairy products. Usually the temperature is held constant by an automated cooling device at 4 °C (39 °F). Suddenly, the device breaks down. Research participants take the role of a supermarket manager who must monitor temperature changes and manually control the temperature using a control bar. Since the temperature is developing in a non-linear way, participants have to observe these changes over time and to counter-regulate with the control bar to stabilize the temperature at the target temperature (see Fig. 1). Products will spoil if the temperature drops or increases too much.

COLDSTORE can be described as low in complexity, moderate in dynamics, and high in opaqueness since decisions have delayed effects and temperature develops in a non-linear way.[1] The time delay between participants'

[1] COLDSTORE is simulated with the following two formula: (1) $\text{regel}_i = \text{regel}_{i-1} + (\text{stoer}_i - \text{regel}_{i-1}) * \text{tempo} - \text{steuer}_{i-1}$, (2) $\text{steuer}_i = (\text{regel}_{i-v} - \text{stell}_i) * \text{regelfaktor}$. The COLDSTORE system is a feedback loop that allows the adjustment of the current temperature value (*regel*) to a target value (4 °C) by manipulating the control wheel (*stell*). Partly the temperature changes are dependent on the outside temperature (*stoer*), time delay (*regelfaktor*), and insulation of the COLDSTORE (*tempo*).