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Occupational Accidents of Finnish- and Swedish-Speaking Workers in Finland: A Mental Model View

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This article is based on 2 studies. The aim of the first study was to examine the differences in occupational accident frequency between the 2 main language groups in Finland. Based on 3 independent statistical data sets, it was shown that Swedish-speaking workers had about 40% fewer occupational accidents than Finnish-speaking workers. The aim of the second study was to confirm the difference at company level. A field study in the province of Vaasa with 14 small and medium-sized manufacturing companies revealed that the accident frequency of Swedish-speaking workers was 21% lower than that of Finnish-speaking workers.

language minority injuries industries
small and medium-sized companies

1. INTRODUCTION

This study belongs to a series of comparative studies on the behavior of speakers of Finnish and Swedish. Earlier studies based on the theory of symbol systems (Strømnes, 1973, 1974a) have shown that the lexical

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markers in the Finnish language (case endings) and the Swedish language (prepositions) refer to totally different structural spatial relations (Strømnes, 1973, 1974c). The relations are overlearned by speakers of the respective languages (Strømnes, 1974c). There are also predictable differences in the use of language between the speakers of those languages (Strømnes, 1974b) and there are systematic differences in the structure of productions filmed by the respective language groups (Strømnes, Johansson, & Hiltunen, 1982). All these studies show consistently that Swedes, who speak an Indo-European language, form mental models that concentrate on continuous movement in a 3-dimensional space, whereas Finns, who speak a Ural-Altaic language, form mental models that concentrate on the relations of entities that are more static.

According to the theory of symbol systems and the research based on it, there are systematic differences in the formation of mental models between people speaking languages belonging to different language groups. These differences become visible when observing the behavior of people, as was done by Strømnes et al. (1982).

All of the aforementioned studies were conducted in Finland. Five point seven percent of the population of Finland (the total population is about 5.1 million) speak Swedish as their mother tongue (Statistics Finland, 1997). The Swedish-speaking minority inhabits particularly the southern and western coasts of Finland (Figure 1). Surprisingly, the biggest Swedish-speaking municipality in the world is situated in Finland, because in Korsnäs 97.6% of the population speak Swedish as their mother tongue.

Finland was a part of Sweden for over 600 years. In 1809 Finland was connected to Russia, from which it separated as an independent state in 1917. As the original Swedish-speaking population came to Finland several hundreds of years ago, it can now be considered a part of the original population.

A cross-cultural comparison of occupational accident rates is difficult because of differences in accident registration, definitions of accident and work, and so forth. Comparison of furniture factories of the same size, type of production, and geographic area showed that the accident rate in the Finnish factories was twice that of the Swedish and Norwegian rates (Söderqvist, Rundmo, & Aaltonen, 1990). A detailed comparison of fatal accidents during a 10-year period, 1980–1989, showed that the fatality rate was highest in Finland (4.2 deaths per 100,000 workers), slightly lower in Norway (3.9), and considerably lower in Denmark (3.0) and Sweden (2.9; Matthiasen et al., 1993). The difference in death rate between Finland and

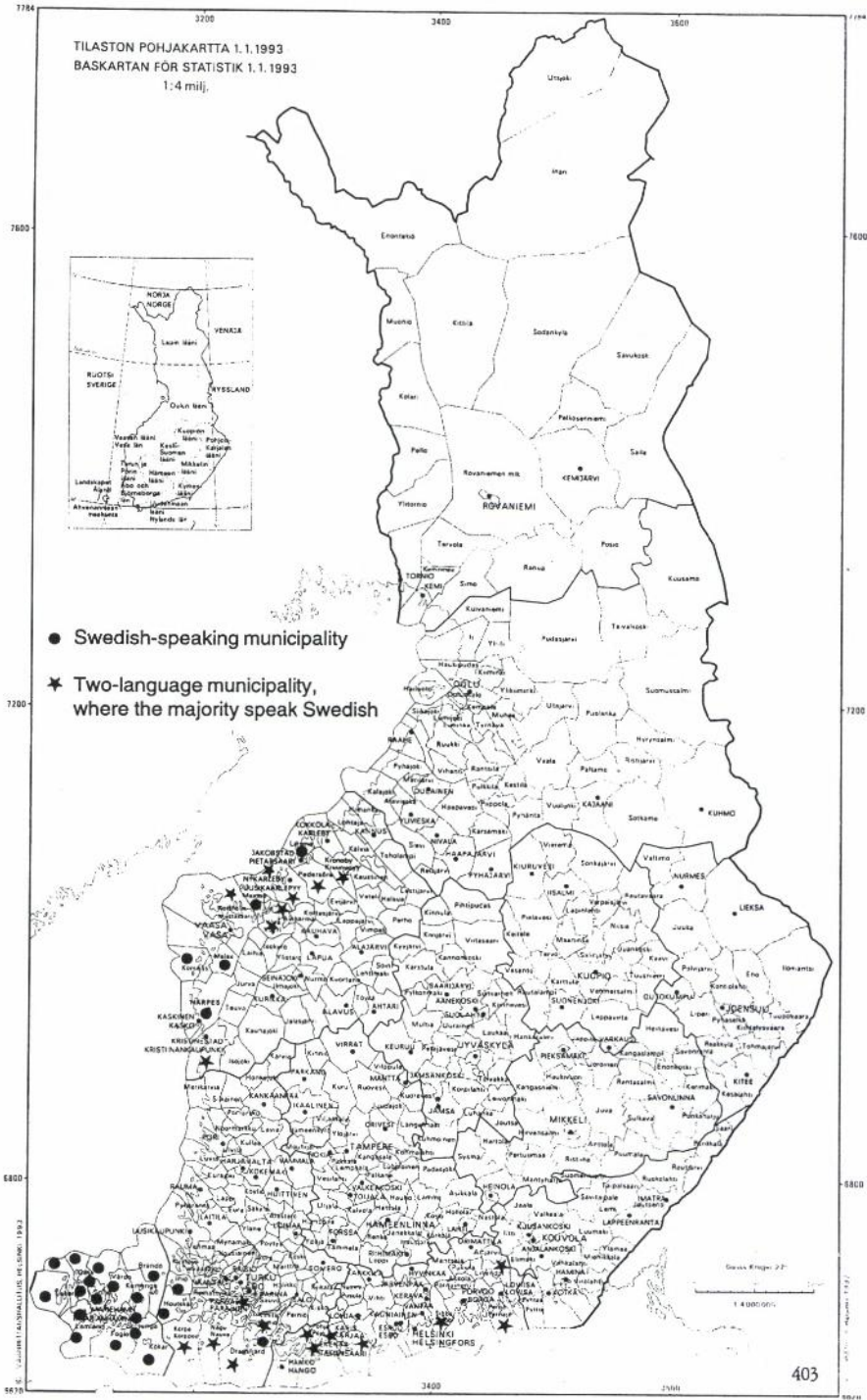


Figure 1. Swedish-speaking population in Finland. From: Maanmittaushallitus (1993), *Tilaston pohjakartta 1.1.1993* [The basic map of statistics 1.1.1993], Helsinki, Finland: Karttakeskus Oy.

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Sweden was 31%. In international comparisons, however, the Nordic countries were among the safest countries in the world (National Safety Council, 1995).

Some previous studies have shown that the accident frequency of immigrant workers has been about three times higher than that of the original population (Al-Arrayed & Hamza, 1995; Bong, Chao, & Lee, 1976; Corvalan, Driscoll, & Harrison, 1994; Fuentes, 1974). On the other hand, some other studies did not find significant differences in the accident frequencies between the original population and immigrant workers (Baker, 1987; Collins, 1959; Döös, Laflamme, & Backström, 1994; Lee & Wrench, 1980). The elevated accident risk for immigrant workers seemed to disappear after 5 years of residence (Corvalan et al., 1994; Döös et al., 1994).

This article is based on two studies. The first one, based on three independent statistical data sets, shows that Swedish-speaking workers in Finland had fewer occupational accidents than Finnish-speaking workers. The second study confirmed the difference between the language groups in 14 small manufacturing companies.

2. STUDY 1: ANALYSIS OF STATISTICAL DATA SETS

The aim of this study was to examine the differences in occupational accident frequency between Finnish- and Swedish-speaking workers in Finland. The examination was based on three statistical data sets and it focused on those parts of Finland where there are most Swedish-speaking people (southern and western coastal areas). Both language groups live together under the same conditions of nature, the same technology, and the same laws and regulations. Two counterarguments were disproved: the under-reporting of accidents by the Swedish-speaking population, and the more hazardous jobs of the Finnish-speaking population.

2.1. Hypothesis

If the differences in accident rates between Sweden and Finland were the cause of economic or legislative differences, there should be no differences between the language groups living in Finland. If, again, there were systematic differences between the two language groups living under the same conditions, the reasons for the differences would have to be sought elsewhere.

Based on the earlier studies by Strømnes, we hypothesized that the differences in the rate of occupational accidents between Finnish- and Swedish-speaking groups might be due to differences in the mental models that affect behavior. Therefore, the hypothesis of the study was that the difference in accident rates between Finnish- and Swedish-speaking populations in Finland would parallel that found between Finland and Sweden.

2.2. Materials and Methods

The first data set came from the Farmers' Pension Institute (1992), which keeps official statistics on farmers' occupational accidents in Finland. The data set consisted of 699 accidents in 1991 in the province of Uusimaa, 2,227 accidents in the province of Turku and Pori, and 2,932 accidents in the province of Vaasa. For each insured farmer there was a named agent in the Farmers' Pension Institute, who filled out the compensation claim. The agents of the Finnish-speaking farmers spoke Finnish, and the agents of the Swedish-speaking farmers Swedish. The mother tongue of the insured farmer was determined by the language used in the compensation claim.

The second data set came from the National Board of Labour Protection (1991), which keeps official statistics on industrial accidents that cause at least 3 days of absence from work. The statistics were based on the compensation decisions made by insurance companies. The forms for the compensation claims were filled out by the foreman of the accident victim. The mother tongue of the victims of occupational accidents in the province of Vaasa in 1990 ($n = 6,991$) was checked in the Population Register Center of Finland.

The third data set was based on an interview study with a representative sample of the Finnish population in 1988 by Statistics Finland (Heiskanen, Aromaa, Niemi, Ruusinen, & Sirén, 1991). The sample consisted of 14,905 persons of whom 12,934 (87%) were interviewed. The participants were asked to report all their accidents during the past 12 months. The number of occupational accidents for the whole Finnish population was calculated by Statistics Finland using weighted coefficients.

2.3. Results

All three data sets showed consistently that Swedish-speaking workers had a lower accident frequency than Finnish-speaking workers (Table 1). This

was true for all three provinces where there is a considerable Swedish-speaking workforce. The difference in accident frequency was greater in the province of Uusimaa (44–54%) than in the provinces of Turku and Pori (33–42%) and of Vaasa (38–40%). The difference between the language groups was statistically significant in all comparisons in which it was possible to calculate.

TABLE 1. Occupational Accidents in a Study of Selected Finnish- and Swedish-Speaking Workers in Finland (Accidents per 1,000 Workers; Johansson & Salminen, 1999)

Source and Year of Accidents Per Province	Finnish-Speaking	Swedish-Speaking	Difference (%)
Farmers' Pension Institute 1991			
Uusimaa	77.6	43.2	44.3***
Turku and Pori	75.3	50.5	32.9**
Vaasa	100.7	61.6	38.8***
National Board of Labour Protection 1990			
Vaasa	39.5	23.7	40.0***
Statistics Finland 1988#			
Uusimaa	87.2	39.8	54.4
Turku and Pori	132.9	77.7	41.5
Vaasa	106.7	66.2	38.0

Notes. Z-test for the difference between proportions: *— $p < .05$; **— $p < .01$, ***— $p < .001$; #—estimates by Statistics Finland. Significances could not be calculated.

One explanation for this result is that Finnish-speaking workers had more accidents because they worked in more hazardous jobs. The accident frequencies in the manufacturing industry were highest in the food industry, carpentry, and in the production of metal products (National Board of Labour Protection, 1991). Table 2 shows that in all these industries Swedish-speaking workers had some 30% fewer accidents. In addition, in the production of vehicles there were more Swedish-speaking workers (1,140) than Finnish-speaking workers (940), but the accident frequency was still lower for Swedish-speaking workers.

The other possible explanation for the lower accident frequency of Swedish-speaking workers is that they worked more often in white-collar occupations and are more often self-employed (Sandlund, 1985), and thus have a lower accident risk. Table 3 partly confirmed this assumption, because the proportions of white-collar and self-employed workers were greater among the Swedish-speaking population. However, the accident

TABLE 2. The Accident Frequency of Finnish- and Swedish-Speaking Workers by Industry in the Province of Vaasa in 1990 in the Data Set From the National Board of Labour Protection

Industry	Finnish-Speaking (<i>n</i> = 33,684)	Swedish-Speaking (<i>n</i> = 8,259)	Difference (%)
Food industry	110.7	56.3	49.1***
Textile industry	30.6	17.1	44.0*
Carpentry	133.8	88.8	33.6***
Paper product and graphic industry	55.3	40.3	27.2*
Furniture industry	52.9	15.3	71.1**
Chemical, plastic, and rubber industry	83.3	64.8	22.2*
Glass, clay, and stone working industry	118.1	73.1	38.1*
Production of metal	79.0	27.8	64.8**
Production of metal products	150.5	115.0	23.6*
Production of machines	75.0	30.1	59.9***
Production of electric machines	59.2	36.3	38.7*
Production of vehicles	84.0	75.4	10.2
Other manufacturing	33.3	22.6	32.2

Notes. Z-test for the difference between proportions: *— $p < .05$; **— $p < .01$, ***— $p < .001$. frequency of Swedish-speaking workers was lower in all status groups than that of Finnish-speaking workers. The difference between the language groups was smallest among white-collar workers (16%).

TABLE 3. The Proportion and Accident Frequency of Finnish- (*n* = 9,202) and Swedish-Speaking (*n* = 485) Workers by Occupational Status in 1988 in the Data Set From Statistics Finland

Occupational Category	Finnish-Speaking (%)	Accident Frequency	Swedish-Speaking (%)	Accident Frequency	Difference (%)
Blue-collar	37.8	121.3	22.5	82.6	31.9
White-collar	47.5	35.2	55.7	29.6	15.8
Self-employed	14.7	103.0	21.8	66.0	35.9
Total	100.0		100.0		

2.4. Discussion

This study was based on three independent data sets from experienced keepers of statistics. The data sets were from three different years, so that the results did not depend on the chance of one year. We can thus conclude that the results consistently and strongly demonstrate that Swedish-speaking workers have fewer occupational accidents than Finnish-speaking workers.

A possible explanation for the lower accident frequency of the Swedish-speaking workers in Finland could be that they have adopted safety

attitudes from Sweden. The safety level in Swedish workplaces is better than in Finnish workplaces, as shown by the lower fatality rate of Sweden (Matthiasen et al., 1993). As the Swedish-speaking people in Finland watch Swedish television programs more than Finnish programs, especially in the province of Vaasa (Nykqvist, 1985, 1990), they have better possibilities to assume safety attitudes from Sweden. According to this explanation, however, the Swedish-speaking workers in the province of Vaasa should have fewer accidents than in the provinces of Uusimaa and Turku and Pori, because in the province of Vaasa it is easy to follow Swedish television and radio programs, which reach this area directly, whereas in the other provinces only some of the programs are relayed. Despite the better possibilities of following Swedish programs in the province of Vaasa, the differences between the language groups were greater in the other two provinces.

Another explanation could be that Swedish-speaking workers report their accidents less often than Finnish-speaking workers. This suggestion was not confirmed in two out of the three cases. Almost all farms in Finland are family farms, which means that the farmers themselves pay the accident costs if they do not report the accident to the insurance company. In the data set from the National Board of Labour Protection (1991), the mother tongue of the accident victim was checked in the Population Register Center of Finland. This procedure eliminated the possibility that, for example, a Finnish-speaking foreman filled out the compensation claim of a Swedish-speaking victim in Finnish. If the accident was not reported, the victim would lose compensation, or the employer would have to pay the victim's wages. So it is in the interest of everyone to report the accidents. In the study by Statistics Finland, underreporting cannot be controlled for. The language variable was controlled for by selecting the participants from the population census with knowledge of the mother tongue and by interviewing each participant in that language (Heiskanen et al., 1991). In the light of the other two data sets, it is highly improbable that underreporting would explain the lower accident frequency of Swedish-speaking workers.

3. STUDY 2: FIELD STUDY IN THE PROVINCE OF VAASA

The aim of this field study was to confirm the lower accident frequency of Swedish-speaking workers in Finland at the company level. That is why we compared identical pairs of Finnish- and Swedish-speaking companies, as

far as possible, so that the language used in the company was the only factor distinguishing the pairs. Accordingly, the pairs were selected so that the number of workers, sales income, branch of industry, and the products were as similar as possible. The companies were small and medium-sized enterprises, because only among them were there purely Swedish-speaking companies. The companies were from the province of Vaasa, where the proportion of Swedish-speaking workers (22%) was the highest in Finland (Central Statistical Office of Finland, 1992). The main hypothesis was that the accident frequency would parallel that found in the statistical study, that is, the Swedish-speaking workers would have considerably fewer occupational accidents.

3.1. Material and Methods

Fourteen small and medium-sized manufacturing companies participated in the study. The language spoken in six enterprises was Finnish, and in six Swedish. Both Finnish and Swedish languages were used together in two enterprises. Eight of the enterprises were metal factories, two were saw mills, two furniture factories, and two dairies. There were 322 Finnish- and 228 Swedish-speaking workers in these enterprises.

The companies reported the accidents during the past 6 years (1990–1995) partly based on the compensation claims to insurance companies and partly based on their own records. The companies also reported the number of employees in each year. The accident frequency was calculated by dividing the number of accidents by the number of workers and multiplying the result by 1,000.

3.2. Results

Table 4 gives the number of occupational accidents (including commuting accidents), number of work years, and accident frequencies of Finnish- and Swedish-speaking workers in the 14 companies. Although the number of occupational accidents for Swedish-speaking workers was only half that for Finnish-speaking workers, the accident frequency of Swedish-speaking workers was 21% lower than that of Finnish-speaking workers ($z = 1.80$, $p < .05$).

Commuting accidents and occupational diseases are not included in the accidents at work in Table 5. The accident frequency of Swedish-speaking

workers was 12% lower than that of Finnish-speaking workers ($z = 0.97$, *ns*). In one enterprise they could not separate accidents at work from other accidents during the first 2 years. Therefore, there was actually a higher accident frequency for Swedish-speaking workers in workplace accidents than in all accidents.

TABLE 4. Accident Frequency (Accidents Per 1,000 Workers) by Language Group in the 14 Companies

Occupational Accidents	Finnish-Speaking	Swedish-Speaking
Number of occupational accidents	160	86
Number of work years	1,645	1,112
Accident frequency	97.3	77.3

The registration of accidents is more reliable for accidents requiring at least 3 days of sick leave. Also in this case the accident frequency of Swedish-speaking workers was 21% lower than that of Finnish-speaking workers ($z = 1.53$, *ns*; Table 5).

TABLE 5. Accidents at Work and Accidents With at Least 3 Days of Absence by Language Group in the 14 Companies

Occupational Accidents	All Accidents at Work		Accidents With at Least 3 Days of Absence	
	Finnish-Speaking	Swedish-Speaking	Finnish-Speaking	Swedish-Speaking
Number of accidents	151	83	116	57
Number of work years	1,643	1,025	1,643	1,025
Accident frequency	91.91	80.98	70.60	55.61

The accident frequency of the language group having a minority status in the enterprises is presented in Table 6. The two bilingual enterprises were excluded from Table 6. There were only four accidents among the Swedish-speaking workers in the Finnish-speaking enterprises, and they occurred in one enterprise. The accident frequency of Finnish-speaking workers in the Swedish-speaking enterprises was 43% lower than that of the Finnish-speaking workers in Finnish-speaking enterprises ($z = 1.54$, *ns*).

TABLE 6. Accident Frequency (Accidents Per 1,000 Workers) by Language Groups in the Enterprises With a Different Language

Occupational Accidents	Finnish-Speaking Companies, N = 6	Swedish-Speaking Companies, N = 6
Finnish-speaking workers		
Number of occupational accidents	104	7
Number of work years	1,277	152
Accident frequency	81.44	46.05
Swedish-speaking workers		
Number of occupational accidents	4	53
Number of work years	16	868
Accident frequency	250.00	61.06

3.3. Discussion

In line with the statistical analysis, the accident frequency of Swedish-speaking workers was lower than that of Finnish-speaking workers in the small and medium-sized enterprises in the province of Vaasa. The difference between the language groups was about 20%, which was less than that in the statistical analysis. This smaller difference between the companies can be explained by the safer companies selected for this study. In this study the frequency of accidents causing at least 3 days of absence was 65 per 1,000 workers, which was lower than for the manufacturing industry (79) and considerably lower than for the metal industry (98) in the same region in 1990 (National Board of Labour Protection, 1991).

This study suggests that Finnish-speaking workers, when they constitute a minority group in Swedish-speaking companies, have considerably fewer occupational accidents than Finnish-speaking workers in Finnish-speaking companies. It is possible that the working methods or the work environments are safer in Swedish-speaking companies, and that the Finnish-speaking workers adopt these methods from their Swedish-speaking workmates. However, the figures are so small that no reliable conclusions can be drawn.

4. GENERAL DISCUSSION

The most important result of this study was the consistency of the results. Three independent statistical data sets showed that the accident frequency of

Swedish-speaking workers was about 40% lower than that of Finnish-speaking workers. A field study in the province of Vaasa indicated that Swedish-speaking workers had 21% fewer accidents than Finnish-speaking workers. In line with these results, the Nordic comparison showed that the fatality rate in Sweden is 31% lower than in Finland (Matthiasen et al., 1993). The first conclusion is that under the same circumstances and the same laws, the Swedish-speaking population can live in a considerably safer way than the Finnish-speaking population. The second conclusion is that the difference in accident rates between Sweden and Finland is probably not due to economic or legislative differences.

The Swedish-speaking people in Finland are an exception from other minorities (Al-Arrayed & Hamza, 1995; Bong et al., 1976; Corvalan et al., 1994; Fuentes, 1974), because they have fewer accidents than the majority. The status of the Swedish-speaking population in Finland as a part of the original population is very much higher than that of other minority groups who live as immigrants. However, the good position of the Swedish-speaking workers at the workplaces did not explain their lower accident frequency because, for example, in the production of vehicles (mostly boats), Swedish-speaking workers as a majority group must also do physically hard work tasks in the province of Vaasa (Table 2), but in spite of this, Swedish-speaking workers had a lower accident frequency than Finnish-speaking workers.

The results of this study are in line with earlier studies on mental model formation (Strømnes, 1973, 1974a, 1974b, 1974c) showing that people speaking an Indo-European language base their thinking on such variables as movement and time. The Finns, who speak a Ural-Altai language, concentrate more on static relations. Comparative studies on television productions by the respective language groups (Strømnes et al., 1982) revealed structures differing greatly from each other. The Swedish and Norwegian (the Norwegian language is very closely related to Swedish) productions had a structure that was strictly ordered in time and space, whereas in the Finnish productions the directors concentrated on the relations between people, almost ignoring the continuity of time and space. If this is also the case of the mental models of workers in real life, then there is a possibility that Finnish-speaking people think of possible dangers in advance less often than Swedish-speaking people. Another possibility is that they fail to observe dangers inherent in dynamic situations as they concentrate on static relations. However, it seems to be possible to learn to act in a safer way. The lower accident rates of Finnish-speaking workers in

Swedish-speaking enterprises is an indication in this direction. More research is needed to clarify this point.

The results of these two studies are taken to be another indication of the different mental models held by people speaking different languages. There may be more differences in thinking between people speaking different languages than we have hitherto explored. This possibility should be of concern for those dealing with minorities and multinational enterprises where people from different language communities work side by side.

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