Perceived Risk as a Constraint on Occupational Performance During Hot and Cold Water Pouring

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Objective. Occupational therapists are interested in quality of movement under different environmental conditions. It has been shown that during reaching tasks, the physical aspects of the objects to be grasped can influence the quality of movement. This study investigated whether perceived risk (water temperature) affected the quality of movement during a pouring task.

Method. In a counterbalanced, repeated measures design, 56 participants (M=27.1 years, SD=7.4 years) poured hot, then cold water to prepare hot and cold beverages. Dependent variables included movement time, displacement, peak velocity, percentage of movement time to peak velocity, and movement units. Data were analyzed with paired t tests.

Results. Participant performance in displacement and movement time was significantly different when considering the entire pouring task for both the hot and the cold conditions (ps < .05). In addition, significant differences were found in the discrete movement “sub-portions” of the pouring task (ps < .05).

Conclusion. Perceived risk is an element of meaning that the occupational therapist can consider in providing the person with just enough challenge to facilitate successful performance. By varying the amount of perceived risk in the occupational form, the therapist can help the person experience and develop the range of movement strategies required by everyday occupations. Future research is needed to corroborate these findings in simple and more complex occupations as well as to examine perceived risk in special populations.


Recent years have shown a strengthening in the systematic study of occupation and the effects of therapeutic occupation using a number of important variables. This is a report of a study investigating the effects of perceived risk on upper-extremity movement dynamics during hot and cold pouring tasks. Before describing the study, we will present its framework, define and describe perceived risk, and describe the kinematics of reaching.

A useful structure for examining a person’s performance is the Conceptual Framework of Therapeutic Occupation (Nelson, 1988, 1994). As viewed from this framework, occupational performance, or voluntary doing, is elicited by an occupational form or an objective set of circumstances external to the person. Occupational forms have both physical and sociocultural dimensions. Each person brings his or her unique developmental structure (sensorimotor, cognitive, and psychosocial characteristics) to bear on an occupational form.
Because of this uniqueness, the meaning an individual derives from an occupational form is individual in nature. Meaning is the result of an interpretive process incorporating both symbolic and perceptual elements. Symbolic meaning involves interpretations of the sociocultural aspects of the form. Perceptual meaning is derived from interpreting the physical aspects of the occupational form. Once a person finds meaning in an occupational form, he or she can determine his or her purpose for, or desired outcome from, engaging in the occupational form, resulting in a unique occupational performance.

Research has supported the premise that occupational forms with enhanced materials (i.e., occupational forms assumed to have greater meaning and purpose for the person) result in different occupational performances than forms that are morerote in nature. Research findings have documented that enhanced occupational forms have produced more movement repetitions (DeKuiper, Nelson, & White, 1993; Hsieh, Nelson, Smith, & Peterson, 1996; King, 1993; Kircher, 1984; Lang, Nelson, & Bush, 1992; Maurer, Smith, & Armetta, 1989; Miller & Nelson, 1987; Riccio, Nelson, & Bush, 1990; Steinbeck, 1986; Thomas, 1996; Thomas, Vander Wyk, & Boyer, 1999; Yoder, Nelson, & Smith, 1989) and greater range of motion than rote forms (Nelson et al., 1996; Sakemiller & Nelson, 1998; Sietsema, Nelson, Mulder, Mervau-Scheidel, & White, 1993; van der Weel, van der Meer, & Lee, 1991). Studies have also shown that enhanced occupational forms resulted in greater duration of pain tolerance (Heck, 1988), greater accuracy of drawing (Licht & Nelson, 1990), greater duration of standing tolerance (Hoppes, 1997), greater subjective preference for occupationally embedded exercise (Zimmerer-Branum & Nelson, 1995), improved movement time performance for turning wing nuts (Rice, 1998), and greater accuracy in tracing a maze while using an upper-extremity prosthesis (Yuen, Nelson, Peterson, & Dickinson, 1994). To date, studies have not addressed the role of perceptual meaning in performance. This study investigated kinesiological aspects of occupational performances that resulted from occupational forms designed to elicit different levels of perceived risk.

**Perceived Risk and Perceptual Meaning**

Risk has been broadly defined as the possibility of suffering harm (Ayres, Wood, Schmidt, & McCarthy, 1998). Perceived risk can be defined as the felt level of personal danger associated with an occupational form. Psychologists have studied the relationship of perceived risk to risky or cautionary behavioral choices (Ayres et al., 1998). Studies indicate that although people can generally assess risk, that risk perception does not play a dominant role in common behavioral choice (i.e., smoking, safe sex) (Rothman, Klein, & Weinstein, 1996). Gibson and Walk (1960) reported classic experiments in which participants coped with a glass floor and a visual cliff, both occupational forms with potentially high levels of perceived risk. Gibson and Walk showed that participants adjusted their response to the glass floor and visual cliff by using more protective behaviors when risk increased. In these cases, perceived risk contributed to perceptual meaning and was assessed through the participant's interpretation of the occupational form.

The physical characteristics of the occupational form such as the size, placement, and the relationship of objects to the person, as well as the texture and temperature of the objects, contribute to the perceptual meaning gained from an occupational form. Hence, persons perceive risk only after the perceptual meaning of the form poses a threat to his or her developmental structure. Psychologists would say that when presented and perceived, risk can result in protective behavior (e.g., caution near a cliff) but may or may not influence more complex behaviors (e.g., alcohol use) (Lanza-Kaduce, 1988). The effect of perceived risk, as an element of perceptual meaning, on individual performance has not been investigated in occupational therapy literature. This study sought to determine whether perceived risk would influence movement dynamics during an occupational performance.

**Kinematics of Reaching**

Generally, adults with no neurological or muscular disorders exhibit two distinct portions within a velocity profile of a "reaching" movement, each with its own unique characteristics (Georgopoulos, 1986). The first usually contains a single large peak (peak velocity) and is thought to be the portion where the limb is literally "thrown" in the direction of the target without reliance on feedback (e.g., visual, kinesthetic) to guide the movement. In contrast, the second portion of the reach involves several smaller peaks relative to the single large one in the first phase. It is thought that during this second phase, the person controls the limb via visual and kinesthetic feedback as the hand gets closer to its target (Carlton, 1981; Keele & Posner, 1968; Viviani, Baud-Bovy, & Redolfi, 1997, Woodworth, 1899).

An important derivative from the velocity profile used in movement analysis is the acceleration profile. Acceleration is defined as the change in the rate of velocity (Miller, 1982). As the body (i.e., limb, finger, or other body part) increases and then decreases its rate of change in velocity, the acceleration profile crosses the zero line from negative to positive. Likewise, as the body decreases then increases its rate of change in velocity, the acceleration profile will again cross the zero line but this time from positive to negative. Together, these two zero-line crossings (from negative to positive, then from positive to negative) have been defined as a movement unit (Brooks, 1974; von Hofsten, 1979). Generally, there are fewer movement units during the first phase. Increased efficiency (i.e., "smoothness") is typically associated with fewer movement units.

Nagasaki (1989) found that differences in the shapes of velocity profiles were related to the experience of the per-
former. For example, when comparing novice and expert golfers, Nagasaki found that during discrete tasks, expert golfers exhibited velocity profiles with a greater peak velocity, which occurred proportionally sooner during the task compared with novice golfers. In addition, overall movement time generally was less for the expert performer compared with the novice performer.

Fitts (1964) and Fitts and Posner (1967) argued that as people learn a task, they traverse through three stages—the cognitive, the associative, and the autonomous. It could be argued that for a person in the cognitive stage, performing a reaching task would elicit a greater peak velocity with a greater percentage of movement time to peak velocity. However, this person, after becoming skilled and performing in the autonomous stage, would elicit a relatively smaller peak velocity and percentage of movement time to peak velocity.

Marteniuk, MacKenzie, Jeannerod, Athenes, and Dugas (1987) showed that the goal of a task causes variability in movement dynamics. They asked participants to grasp a disk and either throw it into a large box or place it into a well. They found that the total movement time was not considerably different for the two conditions. However, the percentage of movement time to peak velocity was less (i.e., occurred earlier) in the “placing” than during the “throwing” condition. This type of velocity profile (where the peak velocity occurs earlier) is indicative of a novel task or one that requires greater precision (Nagasaki, 1989; Marteniuk, et al., 1987; Weir, MacDonald, Mallat, Leavitt, & Roy, 1988).

Wu, Trombly, and Lin (1994) examined the effects of three levels of occupational embeddness on reaching kinematics. The conditions contrasted participants reaching for a pen in preparation to write their name (material-based), reaching as if to retrieve a pen to write their name (imagery), and reaching their arm “forward” (rote exercise). Wu et al. found that in the material-based condition, movement time, peak velocity, percentage of movement time to peak velocity, and movement units were significantly less compared with imagery and rote exercise.

We have presented an introduction to the analysis of upper-extremity movement under various types of constraints and conditions. An area that has not been explored is how perceived risk influences kinematics. One of the tenets of occupational therapy is to provide the client with the “just-right challenge” to optimize therapeutic benefit (Pedretti, 1990). One factor in providing the appropriate challenge is to manipulate the “risk” associated with the occupational form.

The purpose of this study was to examine the effects of perceived risk on upper-extremity movement. The everyday task of making beverages with hot water and cold water was selected to provide movement data on different levels of perceived risk. An assumption of this study was that greater or lesser inherent risk associated with occupational forms will result in different movement dynamics. Hence, the overall, nondirectional hypothesis was that pouring hot water would elicit different movement dynamics compared with pouring cold water. Movement dynamics were represented by the dependent variables of displacement, movement time, movement units, peak velocity, and percentage of movement time to peak velocity.

Method

Participants

The 56 participants in this study included 6 men and 50 women with a mean age of 27.1 years (SD = 7.4 years) and were recruited via written and verbal invitation at a midwestern college. Participants included occupational therapy, physical therapy, and physician assistant students; faculty; and staff members. Participants were self-reported as right-hand dominant and free from any neuromuscular impairment that would limit their ability to participate fully. All participants gave informed consent.

Apparatus

The staging area for this study included a chair for the participants and hot and cold beverage choices displayed on a cabinet. In addition to the beverage choices, the cabinet contained napkins, spoons, an ice bucket, and 8-oz beverage cups with premarked lines to indicate water level. The volume of water at the marked line was 7.39 oz (210 ml).

The testing area contained an adjustable-height table. An 18-in. square area was taped on the floor in front of the table, marking the place where participants were to stand. The Motion Analysis Corporation Hi-Resolution System was used to collect data. Four strobe-equipped Cohu 4915 cameras recorded the movements of the reflective markers at a sampling rate of 60 frames per sec. The cameras were arranged in a semicircle approximately 6 ft from the table. The motion analysis system was calibrated prior to each data collection session.

A Capitol Rangette hot plate, model number CUL255, was used during the hot condition. It was set to maintain the water at 110º F (5 F). Two identically shaped water pitchers were used for the hot and cold conditions. The pitcher for hot condition had an orange handle, and the pitcher for the cold condition had a black handle. The pitchers were filled with 800 ml of either hot or cold water for the respective condition.

A starting block measuring 30.5 cm (length) x 13.3 cm (width) x 10.8 cm (height) was constructed for use in the hot condition. It positioned the hand for the start of the movement and provided a uniform return position at the completion of the movement. Tape on the top of the starting...
block indicated where the participant was to put his or her hand. In the hot condition, the starting block positioned the hand at the same height relative to the water pitcher (which was resting on the hot plate) as in the cold condition. During the cold condition, tape on the surface of the table marked the starting and ending position for the hand. The result was that the starting position for the hand was the same in relationship to the pitcher for both conditions.

Procedure
The task involved pouring water from a pitcher into a cup. Participants performed this two times, once with cold water and once with hot water. Participants were seen individually and were randomly assigned to one of the two possible order of presentation groups (hot–cold or cold–hot). A self-stick reflective marker was attached to the participant’s right hand just proximal to the third metacarphophalangeal joint. The motion of the participant’s hand while pouring the water (more specifically, the reflective marker’s motion) was recorded from the reflective marker by the Motion Analysis Corporation Hi-Resolution System. The table was adjusted so that the starting position for the hand was at the same height of 100.3 cm from the floor in each condition. For the hot condition, the table was lowered to 89.5 cm, and the starting block was used to compensate for the height of the hot plate. After the first condition, participants sat in the staging area and could drink the beverages prepared during the first condition if they desired. During this time, the researchers set up the testing area for the second condition.

For the hot condition, the hot plate was positioned at the front of the table in midline, and the starting block was positioned to the right of the hot plate. The filled pitcher of hot water was then placed on the hot plate.

In the hot condition, the researcher read the following: “I would like you to prepare one of these beverages: hot coffee, hot chocolate, or hot tea.” The beverage options were displayed in front of the participant. Then the researcher asked, “Which would you prefer to prepare?”

After the participant chose a beverage, the researcher brought the participant and the premarked cup to the testing area. The participant was shown where to stand and place his or her right hand. Once positioned, the researcher read the following:

I would like you to pour the hot water into this cup for your (named preferred beverage). Pour it to the line marked on the outside of the cup. Start pouring when I tell you to begin. When you are through filling your cup, put it back on the table and put your hand back on the starting place. Any questions?

Questions were answered, and when the participant was ready, the researcher said, “Begin.” When the task was completed and data were collected, the participant returned to the staging area and completed the preparation of their desired beverage.

For the cold condition, the filled pitcher of cold water was positioned at the front of the table in midline, and a tape marker for the right hand was positioned to the right of the water pitcher. The instructions given during the cold condition were identical to those given during the hot condition, except that participants were offered fruit punch, lemonade, or iced tea instead of hot beverages. In both conditions participants held the cup in their left hands while pouring from the pitcher.

Data Reduction
The occupation of pouring water was operationalized into four discrete movement portions. The first began when the right hand moved from the starting point to reach for the pitcher and ended when the hand grasped the handle of the pitcher (Portion A). The second portion began when the right hand grasped the pitcher handle and lifted, orienting it in relation to the cup being held with the left hand (Portion B). The third portion began as the right hand poured the liquid into the cup and ended when the pouring stopped (Portion C). The fourth portion began when the right hand stopped pouring the liquid and ended when the pitcher was set back down (Portion D).

The dependent variables were calculated in the following manner. Displacement was the resultant displacement in a three-dimensional space and was calculated by taking the square root of the squared displacement in the x, y, and z axes. Movement time was calculated by measuring the time between the beginning and ending points of the movement. Peak velocity was determined as the maximum velocity within a given movement portion. Velocity was calculated by dividing the displacement by the movement time. The percentage of movement time to peak velocity was the point during the reach when peak velocity occurred, expressed as a percentage of the total movement time. Movement units were calculated by counting the number of times the acceleration curve crossed the zero line from negative to positive and back to negative where the magnitude of the acceleration was greater than ± 5 mm/sec (Brooks, 1974; Kluzik, Fetters, & Coryell, 1990).

Peak velocity and the percentage of movement time to peak velocity are not appropriate for measuring movements that do not include a reaching component. Portion C involved pouring water from a pitcher to a cup and did not involve a reaching component. Therefore, peak velocity and percentage of movement time to peak velocity were not analyzed during movement Portion C.

Data Analysis
The study is a counterbalanced repeated measures design. Each participant acted as his or her own control across the two conditions. Paired t tests were used to statistically analyze the difference between the hot and cold pouring conditions for each dependent variable. A paired t test is appropriate for this type of design that has two levels on the repeated factor (Johnson & Wichern, 1992; Rosenthal &
The hot condition was greater than the cold condition in all portions except for peak velocity in Portion B where the cold condition was significantly greater than the hot condition. The effect sizes for displacement, movement time, and movement units were significantly greater in the hot condition than during the cold condition. The results of the paired t-tests and effect sizes are presented in Table 2.

### Results

Table 1 contains the means and standard deviations for the dependent variables in the cold and hot conditions. Table 2 summarizes the paired t-tests and effect sizes for each dependent variable. No presentation of order effects were found (p > .05).

When considering the occupation of water pouring in total (from the beginning of movement, Portion A, to the end of movement portion D), movement time, displacement, and movement units were significantly greater during the hot condition than during the cold condition. The effect sizes for displacement, movement time, and movement units were in the medium range.

### Portion A, Start to Handle

The displacement in the hot condition was significantly greater than in the cold condition and had a medium effect size. There was no difference in movement time and no effect size. Peak velocity in the hot condition was significantly greater than in the cold condition and had a small effect size. There was no difference in percentage of movement time to peak velocity or in movement units between the two conditions. However, there was a small effect size for both percentage of movement time to peak velocity and movement units.

### Portion B, Pitcher to Cup

There was significantly greater displacement and movement time in the hot condition than in the cold condition. The effect sizes for displacement and movement time were in the medium range. Peak velocity was significantly greater in the cold condition than in the hot condition. There was a small effect size with peak velocity. There was no difference in percentage of movement time to peak velocity, nor was there an effect size. Movement units were significantly greater in the hot condition than in the cold condition, with a medium effect size.

### Portion C, Pour

There was no difference in displacement between the two conditions. Both movement time and movement units were significantly greater in the hot condition than in the cold condition.
cold condition. There were small effect sizes for displacement, movement time, and movement units.

**Portion D, Replace Pitcher**

The displacement in the hot condition was significantly greater than in the cold condition and demonstrated a small effect size. There were no differences in movement time, peak velocity, percentage of movement time to peak velocity, or movement units between the two conditions. The effect size for peak velocity was small, and there was no effect size for percentage of movement time to peak velocity or movement units.

**Discussion**

The results of this study support the overall hypothesis that pouring hot water elicits different movement dynamics compared with pouring cold water. When considering the entire task of pouring water, displacement, movement time, and movement units were significantly greater in the hot condition compared with the cold condition. On the basis of these differences, we can assume that the participants perceived the hot water condition differently than they perceived the cold water condition and, hence, adjusted their water-pouring performance accordingly. Participants took more time and moved the hot water pitcher a greater distance to reduce the relatively high level of risk that they perceived in the hot condition compared with the cold condition. No participant spilled water in either condition, indicating that all participants successfully adjusted their movements to accomplish the pouring task.

The operation of water pouring also was analyzed by its discrete movement portions. This water-pouring occupation contained four movement portions (A–D). Portion A involved reaching for the pitcher from the starting position. The trend in the cold condition of lower peak velocity and shorter percentage of movement time to peak velocity follows the profile associated with greater skilled or experienced movements (Nagasaki, 1989). However, in contrast to Nagasaki (1989), this task did not involve a “training” component, and because participants acted as their own control during these two very common tasks, we cannot infer skill level from the velocity profiles. Indeed, pouring liquid from a pitcher to a cup is assumed to be a very well-learned task among this study sample. Perhaps, the perception of risk in the hot condition elicited greater attention to the task, thereby causing the participant to perform the task from more of a “cognitive” state than an “autonomous” state as described by Fitts (1964) and Fitts and Posner (1967). During the hot condition, the knowledge that the hand moved in proximity to the hot pitcher of water, located on a hot plate, may have caused the participant to think about how he or she was moving his or her limb more than in the less threatening cold condition. Hence, the movement dynamics contained greater peak velocity and longer percentage of movement time to peak velocity in the hot condition.

Portion B involved moving the pitcher to orient it to the cup being held in the left hand. The risk involved with this portion is arguably greater than in the other portions of the task. The movement in Portion B involved greater acceleration of a full pitcher of water than other portions of the movement. If the acceleration was too great, the water would have spilled, yet if the acceleration was too slow, the participant may have believed that he or she was taking too long to move and orient the pitcher. Participants had to reconcile this paradox by moving the pitcher with an appropriate amount of acceleration and deceleration and at the same time, by moving the pitcher in a timely manner. Each participant had a goal of pouring water into a cup without spilling. He or she perceived the occupational form (e.g., hot or cold water) and demonstrated an appropriate occupational performance. During the hot condition, participants took a longer movement time in Portion B, with greater displacement and greater movement units compared with their performance in the cold condition. In addition, participants demonstrated a lower peak velocity during the hot condition, indicating an increased perception of risk in handling hot versus cold water.

Portion C involved the actual pouring of water into the cup. The purpose of Portion C was to fill the cup to the designated line. It required tipping the pitcher and orienting the spout so that water flowed into the cup. This movement portion did not involve reaching and, hence, elicited a different movement pattern. The movement pattern in Portion C involved much less displacement compared with the other movement portions but involved greater movement time and movement units. The relative risk was high in that water was flowing from one container to another through mid-air. Such a task, although common, is anything but trivial. Its obvious complexity can be observed in the actions of a small child attempting to pour milk from a gallon jug into his or her cup. Successful pouring requires an acute awareness of gravitational forces and spatial orientation as well as the ability to integrate proprioceptive, kinesthetic, and visual information (Schmidt, 1988). The relatively high inherent risk associated with the hot condition resulted in greater movement time and movement units than during the cold condition. In addition, there was no difference in displacement. Because displacement was the same for both conditions, but movement units were greater, it follows that the participants made more “adjustments” to compensate for handling the more “risky” hot water compared with the cold water. It also follows that the participants took more time pouring hot water, indicating that the water flow rate from the pitcher to the cup was less as well.

As in Portion B (moving pitcher to cup), Portion D
(replacing pitcher) involved reaching. However, instead of moving away from the table, the water pitcher in Portion D is moved toward its resting place on the hot plate or the table. In this portion, only displacement was greater in the hot condition. The target area for placing the pitcher was different in the two conditions. The hot condition had a well-defined target in the heating element, whereas the cold condition had a less defined tabletop target. Perhaps the presence of a more defined target in the hot condition elicited a longer trajectory (and hence greater displacement) compared with the cold condition. Although target size has been shown to affect movement time (Fitts, 1954; Fitts & Peterson, 1964; Fitts & Posner, 1967) and trajectory variability (Soechting, 1984), research addressing trajectory displacement is lacking. The difference in perceived risk may have been minimal because the pitcher was less full (25% less) in this movement portion than in previous movement portions. No differences were found among the other variables.

The findings of this study demonstrate that perceived risk can elicit different occupational performances, in this case, movement patterns. This is the first study in the occupational literature that documents the effect of perceived risk on performance. Because this study is the first in this line of research, it is important to generalize conservatively.

The results of this study suggest that perceived risk as interpreted perceptually by the person can influence the movement dynamics required for a pouring task in a young adult population without disabilities. If further research replicates this finding and shows it exists in other tasks of variable risk, occupational therapists will be able to use perceived risk as a means of increasing or decreasing the challenge provided by intervention choices.

Occupational therapists are concerned with synthesizing safe occupational forms that offer an amount of challenge appropriate to individual developmental structures. A person recovering skill in upper-extremity movement needs to test and refine reaching and manipulating skills within forms that offer the "just-right challenge." The dimensions to be considered by the occupational therapist include the appropriate amount of physical challenge (e.g., range of motion, strength, type of grasp, coordination), cognitive challenge (e.g., attention span, memory, sequencing, problem solving), and psychosocial challenge (e.g., role integration, interpersonal interaction, interests). Perceived risk appears to be an element of perceptual meaning that the occupational therapist can consider in providing the person with just enough challenge to facilitate successful performance. By varying the amount of perceived risk in the occupational form, the therapist can help the person experience and develop the range of movement strategies required by everyday life.

This study's limitation was that there was no control for whether participants consumed their beverages. Some participants drank both hot and cold beverages; some participants drank only one, whereas other participants drank neither. Although no order effects were found, it is possible that the participants who drank their first beverage lost their desire to consume a second beverage. It is unclear whether this affected movement dynamics in the second condition. In addition, it may be rather unnatural for some persons to prepare one hot and one cold beverage in a relatively short period. Further, as mentioned previously, the hot condition involved a starting block, which is not a naturally occurring occupational form. A starting block was not included in the cold condition; as such, it could have influenced the occupational performance in the hot condition.

Further research, including replication of this study, is needed to corroborate these findings. Research studies are needed that would extend the results to other occupational forms that involve varying amounts of perceived risk. For example, it would be interesting to contrast the movement dynamics during a food preparation occupation. One condition may involve stirring a pot of boiling soup placed on a hot stove versus stirring a pot of room temperature soup placed on a countertop. The increased temperature of the soup as well as the presence of the stove may be perceived as having greater risk than the condition with the room temperature soup and countertop. Research on the effects of perceived risk also is needed with other age groups and with persons with disabilities commonly seen by occupational therapists.

Conclusion

In this study, we examined the effect of perceived risk on performance of a discrete task, namely pouring water to make hot and cold beverages. We found that the movement dynamics for the two conditions were different for the overall tasks and the discrete, subportions of the tasks. Participants adjusted their movement time, movement units, displacement, and velocity to accommodate the perceived risk they associated with the task. The results demonstrate that as an element in the occupational form, varying levels of risk may be perceived and, hence, change the movement dynamics required to successfully complete a task. Additional research is needed to corroborate this study's findings. If similar results are found, occupational therapists should grade perceived risk when trying to help persons develop the variety of movement strategies needed in everyday occupations.

References


