

RESEARCH ARTICLE

Will Environmental Interventions Affect the Level of Mastery Motivation among Children with Disabilities? A Preliminary Study

Amiya Waldman-Levi^{1,2*††} & Asnat Bar-Haim Erez²

¹Hebrew University, Jerusalem, Israel

²The Occupational Therapy Department, Ono Academic College, Israel

Abstract

Children with developmental disabilities tend to demonstrate lower levels of mastery motivation in comparison with typically developing children. The goal of this study was to investigate the effect of physical and social environmental interventions on the mastery motivation of children with disabilities. Participants included 19 children (from two classes) with disabilities between the ages of 2–4 years from an educational rehabilitation centre. The Individualized Assessment of Mastery Motivation was used to assess the level of mastery motivation; the Early Childhood Environment Rating Scale – Revised and the Teacher–Child Interaction Observation were used to assess the physical and social environments. A counterbalance study design was used such that the children from the two classes received two phases of intervention, social and physical environmental interventions. The study's results point to the advantage of the social intervention, over the physical one, in improving the child's mastery motivation. However, the results lend support for the efficacy of using both aspects of environmental changes to the overall persistent score. The study findings, although preliminary, demonstrate the efficacy of providing both social and physical environmental interventions to improve mastery motivation. Copyright © 2014 John Wiley & Sons, Ltd.

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Keywords

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*Correspondence

Amiya Waldman-Levi, 84 12th street, Cresskill, NJ, 07626, USA.

†Email: amiyawl@gmail.com

*Formerly at the time study was conducted, School of Occupational Therapy Hadassah, Jerusalem, Israel

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Introduction

Mastery motivation (MM) is defined as the inherent drive (psychological force) that leads young children to explore and master their environment and is expressed through interest and persistence in challenging activities (Hauser-Cram, Krauss, Warfield, and Steele, 1997; Kelley, Brownell, and Campbell, 2000). MM emerges in late infancy, may be a precursor to self-determination,

setting a course of increased independence and an enhanced perception of ability to control one's environment (Gilmore and Cuskelly, 2009; Iqbal-Hashmi, Seok, Hj Halik, and Ading, 2012). Researchers suggest that this type of motivation represents a crucial element in promoting developmental changes (Bartlett, 1999; Mercer-Young and Hauser-Cram, 2006) and participation in leisure and everyday activities (Bartlett and Palisano, 2002; Majnemer,

Shevell, Law, Poulin, and Rosenbaum, 2010; Iqbal-Hashmi et al., 2012).

Learning theories emphasize aspects of both the physical and social environments in the acquisition of MM (Busch-Rossnagel, 1997; Gottfried, Flemming, and Gottfried, 1998; Evans, 2006). Turner and Johnson (2003) claimed that motivational patterns develop early as a function of family variables and have the potential to influence academic success. Furthermore, there is evidence of the association between the interaction of young children with their mothers and/or primary caregivers and the development of MM (Mercer-Young and Hauser-Cram, 2006). Kelley et al. (2000) examined 75 toddlers (35 girls and 40 boys) and their mothers. They examined maternal controlling behaviour and evaluative feedback while mothers taught their 24-month-olds a challenging task. Mothers' praise and joint smiles of pleasure were positively related to their children's task motivation, whereas their physical interruptions and critical remarks were negatively related to children's motivation. High maternal control also has been shown to reduce task enjoyment, persistence and a sense of control in young children. Studies examining the factors that influence MM within the physical environment, especially in school settings, include accessibility to materials, space for play and the overall safety of the surroundings (Grinder, 2007). Gottfield and colleagues (1998) showed that access to objects and/or materials that possess novel features, complexity or unexpected elements may have a positive effect on children's MM (Robinson, Rudisill, and Goodway, 2009; Majnemer et al., 2010).

Children with developmental disabilities may exhibit lower levels of MM compared with their non-disabled peers (Mercer-Young and Hauser-Cram, 2006). Consequently, it may be one of the reasons they tend to avoid participating in challenging activities (Hauser-Cram, 1993). Mercer-Young and Hauser-Cram (2006) examined the maternal interaction style towards children with developmental disabilities born preterm with low levels of MM. The authors reported that intense parental involvement overly structuring the child's behaviours and limited opportunities for autonomy might have impacted MM. A study performed with children with cerebral palsy found that their levels of MM were lower in comparison with their typically developing peers. The researchers suggested that these differences may stem from the children's motor deficits, which compromise their ability to fully engage and explore the environment (Majnemer et al., 2010). Interesting findings were

reported in a study that compared between children with motor delay and children who were developing typically, aged 15 to 47 months. The key findings of this study were that toddlers with motor delay, who were given tasks that were moderately difficult for them, had behavioural levels of persistence and pleasure similar to those of mental age-matched children with typical development. However, children with motor delay were rated lower on persistence as perceived by their mothers (Wang, Morgan, Hwang, and Liao, 2013).

The World Health Organization has highlighted the importance of the environment in supporting or hindering individuals' engagement and participation in life situations (World Health Organization, 2002). Therefore, it is of utmost importance to relate, and adjust, to both the physical and social environments of children with developmental disabilities. Although studies have indicated the possible impact of the environment on children's MM, to the best of our knowledge, it has not been addressed in rehabilitative interventions, involving modification of children's environment (Majnemer et al., 2010). The goal of the current preliminary study is to examine the efficiency of an intervention programme for children with developmental disabilities, by modifying both their social and physical environments, in order to enhance their MM. Thus, the study hypothesis was that there will be differences in MM within each class before and after each intervention.

Methods

Study design

This study employed a counterbalanced research design (Figure 1).

Participants

The sample included 19 children from two different classes who attend a special rehabilitation-education school ($N=170$) with a variety of developmental disabilities. The age of the children ranged from 2 to 4 years (24 to 48 months). In this particular school, children are assigned to classes on the basis of functional and cognitive levels rather than chronological age. Thus, chronological age can differ significantly between classes. Study inclusion criteria were the following: (1) a medical diagnosis of developmental disability including cerebral palsy, spina bifida (myelomeningocele) and non-specific

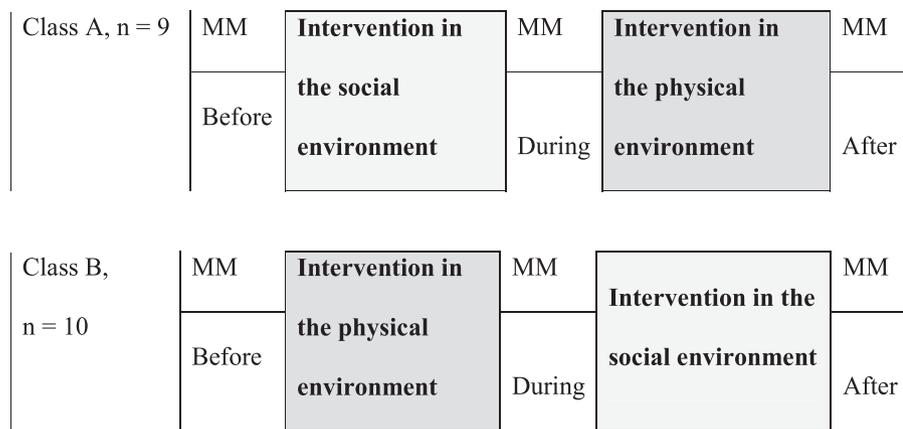


Figure 1 Study design and intervention order

developmental delay (other); (2) age range from 2 to 4 years; (3) hand function that enables the performance of the various study procedures; and (4) parental consent to participate in the study. Children with moderate-to-severe cognitive disability (on the basis of the information from children's school files) were excluded from the study. Table I presents the distribution of the two classes within the study sample with respect to age, gender and medical diagnosis.

Measures

Individualized Assessment of Mastery Motivation (IAMM; Morgan, Busch-Rossnagel, Maslin-Cole, and Harmon, 1992)

The IAMM assesses MM among children with a mental age of 15 to 36 months by examining their performance on three different types of activities:

puzzle assembly (PA), shape sorting (SS) and cause and effect relations (CE). For the current study, the toys required for each possible activity were carefully selected to fully adhere to the manual-specific guidelines. Each type of activity consists of six levels of difficulty, allowing the examiner to adjust the optimal level of difficulty (e.g. level of challenge) for the child. An activity is classified as moderately challenging when the child is able to discover one of the possible solutions available within 120 seconds. If a child can find all possible solutions within 120 seconds, a more challenging activity is presented. In situations when a child cannot find any solution within 120 seconds, an easier activity is presented. This individualized method for assessing MM attempts to separate the child's motivation from his or her competence.

During the performance in each of the given set of activities, the examiner assesses the child's persistence, pleasure and competence in finding various solutions. However, the scale's authors mentioned that pleasure and competence are less frequent than persistence and empirically are not highly correlated with task persistence (Dichter-Blancher et al., 1997; Hauser-Cram et al., 1997; Kelley et al., 2000). Thus, in the current study, we present task persistence score only, for the three activities (PA, SS and CA). Scores are recorded during each 15-second interval within a 4-minute period. The score for persistence is calculated on the basis of the number of intervals with "on-task behaviour"; thus, scores can range from 1 to 16.

The IAMM has high levels of inter-rater reliability for persistence in each of the three types of activities (CE, $r = 0.81$, $p < 0.05$; PA and SS, $r = 0.96$, $p < 0.05$).

Table I Participants' age, gender and medical diagnosis

	Class A <i>n</i> = 9	Class B <i>n</i> = 10
Age in months		
Mean (SD)	41.44 (5.2)	33.8 (3.8)
Gender [<i>n</i> (%)]		
Male	4 (55.6)	7 (70.0)
Female	5 (44.4)	3 (30.0)
Medical diagnosis [<i>n</i> (%)]		
CP	6 (66.7)	6 (60.0)
MMC	2 (22.2)	1 (10.0)
Other	1 (11.1)	3 (30.0)

N = 19. SD = standard deviation; CP = cerebral palsy;

MMC = myelomeningocele.

The IAMM test–retest value was reported to be low; however, measures of the test’s validity (construct, criterion and discriminate) were reportedly high (Jennings, Conners, and Stegman, 1988; Morgan et al., 1992). In the current study, inter-rater reliability was found to be significantly high ($n=25$, $r=0.99-1.0$, $p<0.01$). Jennings et al. (1988) reported stability in the scores of preschoolers, 3.5–4.5 years old, for persistence. As for the “learning affect,” as described earlier and based on the studies, it seems rather unlikely to affect the children’s scores, as each task, at each measurement period, was carefully chosen by the examiner to meet the child’s level of performance according to the IAMM manual.

The Early Childhood Environment Rating Scale – Revised (ECERS-R; Harms, Clifford, and Cryer, 2005)

This scale is designed to be administrated to groups of children aged 2.5 to 5 years old, such as those attending day care facilities and schools. It enables the examiner to determine a class profile regarding the children’s social and cognitive academic environment. It was not designed for special education schools, although it has been reported to have been used with children with developmental disabilities. The ECERS-R assesses both the social and physical environments and includes 43 items grouped into seven categories: space and furniture, self-care routine, language and cognition, activities, interactions, curriculum, parents and staff. According to the manual, the ECERS-R can be administered in its entirety or each category can be administered on its own. Each of the 43 items is scored on a 7-point scale, in which 1 indicates *insufficient* and 7 indicates *sufficient*. Category scores are determined by averaging the individual items so that scores can be obtained for each individual category.

In the current study, the “space and furniture” category was administrated to assess the compatibility or incompatibility of the class environment. The child–teacher interactions were explored by assessing the following: (1) independence – the degree to which a child’s exploration and play is supported; (2) persistence – the degree to which the child is encouraged to persist with a task and/or play activities; (3) mediation –

enhancing the child’s ability to play with a minimal degree of mediation (“just the right amount” of cueing); and (4) reinforcements – used to promote the child’s engagement with materials and activities.

Procedure

The study was authorized by the Internal Review Board of the participating school after which the school’s teachers were given a general introduction to the study. Two classes, referred to as class A and class B, were selected on the basis of the fact that these classes had the greatest number of children within the target chronological age. A letter of explanation and a consent form were sent to all parents of children in the experimental classes. Children with moderate-to-severe cognitive disabilities, as determined by their school record, and with poor hand function were excluded from the study. All testing was conducted during the morning or early afternoon hours and was videotaped with a stationary video camera. Children were escorted to the testing room by one of their caretakers, who stayed with them while the tests were administrated.

The ECERS-R observation for assessing the physical qualities of both classes’ environments was carried out for an hour during a typical school day. Along with this observation, pictures of the classes were taken as well as drawing and measurements of its size, layout and display. The intervention for the physical environment was administrated to each class by educational and therapeutic staff during a supervisory meeting. Then, monitoring of the implementation and maintenance of the guidelines were conducted on twice a week basis.

The social environment was assessed by conducting an observation in the two classes, separately, during a typical school day and lasted for 2 hours, allowing the examiners to observe all sorts of activities. By completion of the observation period, analysing and interoperating its findings, the social environment intervention guidelines were established. A supervision meeting was conducted for both classes’ educational and therapeutic staff.

Following the supervision process, the interventions were implemented for a period of 6 weeks to classes A and B, in an alternating sequence (Figure 1). The IAMM was administrated prior to allocation of each intervention and at the end of the interventions.

Pre-intervention – environments' assessments findings

The physical environment

The findings of the ECERS-R assessment of the physical environment in relation to space and furniture within each class (A and B) indicated of its low qualities as follows:

- (1) Furniture arrangements and space – both classes were dense, and there were unnecessary furniture. The classes were cluttered and lacking basic hygiene (bins were full, food leftovers on the floors next to the kitchenette).
- (2) Furniture arrangement that allows for a “quiet area” – in both classes there was no soft furniture area for relaxation, or there were not any accessible stuffed toys for the children to play with during the day.
- (3) Class division into specific interest areas – in both classes, there were not any designated areas for different activities. Areas allowing active play were blended with other areas; toys were not arranged in any sort of order, rather packed on shelves.
- (4) Room arrangement that fosters child's autonomy – in both classes, there was no specific area that allows children privacy, yet, can be supervised by the staff. There was no space that provided children with the opportunity to be engaged in a small group play (two children) without the interruption of others.
- (5) Accessible display of children's projects – most of the visual display in each class was not of children's art projects, and most was hung out above their eye level. There was no display of children's three-dimensional projects.

The social environment

The findings of the ECERS-R and the child–teacher interactions observation assessments of the social environment of each class (A and B) indicated of its low qualities as follows:

- (1) Free play and child's independence – in both classes, there were not sufficient time for free play during the day. When some children were engaged in free play, the staff tended to intervene.
- (2) Delayed response – teachers were providing help, too easily as a child asked, sometimes even before

a request was even noticed. They did not allow sufficient time for the children to independently explore for various solutions.

- (3) Verbal mediation – children were encouraged to play or learn using minimal in consisted verbal mediation for some activities. At other activities, teachers were using modelling or provided a ready solution for the problem the children encountered.
- (4) Verbal reinforcement – teachers provided general verbal reinforcement for the end product rather than to the process. Children were, occasionally, given prizes, treats or stickers for completing a task.

Environmental interventions

Intervention relating to the physical environment

The intervention was based on the guidelines described in the ECERS-R (Harms et al., 2005):

- (1) Furniture arrangement and space – furniture were rearranged to allow for more space and mobility within the class. Unnecessary items were removed, classes were cleaned and uncluttered and a list was hung by the classes' wall to indicate the times for cleaning and organization of the space.
- (2) Creation of a “quiet area” – a space in each class was designated for relaxation and sensory modulation that included items such as deep soaking coaches, puffs, pillows and stuffed animals accessible to the children.
- (3) Class division into specific interest areas – the following principles were used to guide this type of arrangement: a well-defined space was demarcated by furniture arrangement; the number of possible distracters was reduced; the areas were designed to be engaging, stimulating and challenging for the children; and the class included spaces conducive to social interaction as well as a space for quiet time.
- (4) Room arrangement that fosters child's autonomy – the specific interest areas, furniture arrangement and the use of dividers provided a feeling of privacy. This facilitated the children's sense of autonomy and independence during individual as well as social play.
- (5) Accessible display of children's projects – children's arts, crafts projects, decorations and visual-educational content were displayed at a height suitable for the children.

- (6) Restricted number of attending adults – to ensure adequate spacing and encourage the children’s mobility, the number of attending caregivers was restricted. Once the set limit of adults in the room was reached (four adults), a sign was hung requesting newcomers to wait until another adult had left.

Intervention relating to the social environment

This intervention was based on an observational assessment of the child–teacher interactions and was developed for the current study on the basis of the literature. Relevant categories, such as those in the ECERS-R, were further elaborated.

- (1) Free play and child’s independence – free play was set regularly for half an hour a day when all children were present, at a time when no therapeutic sessions were scheduled. The children were made aware that free play was the time in which they could explore, initiate and/or choose activities and decide whether or not to engage with others without guidance from their teachers. The teachers were instructed to avoid structuring, scaffolding or mediating the children’s play activity.
- (2) Delayed response – the teachers were instructed to delay their response to provide assistance, for 2 minutes, as long as the children’s safety was not being threatened. This modification provided the children with the opportunity to try and cope and find solutions to everyday challenges, independently.
- (3) Verbal mediation – verbal mediation was provided in the “one step forward” scaffolding method. That allowed the child to first try to resolve a problem independently, as well as to have some assistance. Assistance was carefully provided in the form of graded cueing, which was adjusted to the child’s specific abilities and difficulties.
- (4) Verbal reinforcement – this modification supported children’s engagement in activities and play for the sake of the pleasure they derive from the process. Positive feedback is given for independent problem-solving rather than for the achievement of the end product. This type of reinforcement decreases children’s dependency on external reinforcement, such as prizes or treats.

Statistical analysis

Statistical analysis was carried with SPSS (IBM SPSS Statistics for windows version 21, Armonk, NY, USA). Study questions were analysed at a $<.05$ level of significance, for each class separately, as this study scope was in relation to the order of introducing the interventions rather than comparing between groups. Because of the repeated assessment, of each participant, we used repeated-measures analysis of variance with post hoc tests using the Bonferroni correction. Because MM persistence scores did not follow a normal distribution as well as the small sample size, the analysis was carried out using Greenhouse–Geisser correction to determine whether that the mean overall persistent measure of IAMM differed significantly between time points within each group.

Results

A repeated-measures analysis of variance with a Greenhouse–Geisser correction determined that mean overall persistent measure of IAMM differed significantly between time points, for the two classes – class A ($F(1,42) = 7.50, p < 0.05$); class B ($F(1,19) = 5.88, p < 0.05$). Overall, the children in both classes, who received the environmental interventions (social and physical) improved in their persistent MM scores at the end of the study. However, there were differences in the pattern of improvement. Post hoc tests using the Bonferroni correction revealed that a statistically significant change in the IAMM level was measured between

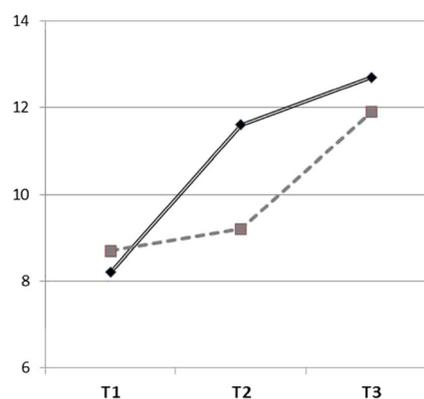


Figure 2 Pattern of improvement in overall persistent score
 ◆— Class A: T1–T2 = social environment intervention; T2–T3 = physical environment intervention.
 ■- - Class B: T1–T2 = physical environment intervention; T2–T3 = social environment intervention.

pretest (T1) and post treatments (T3) only for class A, which received the social intervention first ($p < 0.05$); although class B also improved, it did not reach the statistical significance. It should be noted that in both groups, the social intervention elicited a greater increase in overall persistence IAMM score (Figure 2); In class A, this was apparent between the first and the second assessments and in class B between the second and third measures. However, this increase did not reach statistical significance. As for the different tasks of the IAMM, significant differences were noted only in the cause-effect task – class A ($F(1,21) = 7.47, p < 0.05$); class B ($F(1,20) = 9.41, p < 0.05$). Post hoc tests using the Bonferroni correction revealed that significant differences were noted between pretest (T1) and post treatments (T3) for both classes ($p < 0.05$). Descriptive statistics for persistent scores are presented in Table II. In Figure 2, the change in scores post each treatment phase is presented graphically to demonstrate the increase post the social intervention.

Discussion

Mastery motivation is an essential trait in young children for successfully exploring their environment. Research suggests that children with developmental disabilities may exhibit low levels of MM in comparison with typically developing children. This might further result in increased reliance on their caregivers and teachers for assistance and solutions to challenges. These types of behaviours may affect their participation in everyday life activities, such as learning and playing, which normally encourage children's development and maturation. Specific social and physical environments were found to have a positive effect on the development of children's MM. Thus, creating environmental interventions that can help foster MM in young

children with developmental disabilities would be exceedingly meaningful for their overall well-being. The current study investigated the efficiency of an intervention programme, which involved the modifications of the social environment and the physical environments, for children with developmental disabilities.

Efficiency of the intervention related to the social environment

The social environment modifications were found to be effective in improving MM of the children in both classes A and B; however, the last did not reach statistical significant. This improvement signifies that the study participants were able to cope with the challenges involved in performing a given task. These results support the literature regarding the impact of parents and caregivers in facilitating the development of MM, especially for children with significant deficits (Busch-Rossnagel, 1997; Mercer-Young and Hauser-Cram, 2006).

Efficiency of the intervention related to the physical environment

In this study, the children in both classes showed only modest improvement after modifications made to the physical environment; however, the improvement did not reach statistical significant and appeared to be less apparent than the social intervention. It is important to note that the teachers reported that all the modifications in the environment were perceived by the children as novel and surprising. It might be inferred that this impression of novelty and surprise acts as stimulators, which then encouraged the children to further explore and interact in their environment. One might assume that a possible desire to explore and interact was translated to better performance in

Table II Mastery motivation levels: means and standard deviation for persistence before and after interventions

	Class A (social interaction first)			Class B (physical environment first)		
	T1	T2	T3	T1	T2	T3
Puzzle task	8.00 (5.3)	10.25 (6.0)	11.50 (3.7)	6.90 (4.5)	6.78 (5.3)	10.44 (4.6)
Shape sorter task	8.78 (5.4)	12.25 (4.3)	12.88 (4.5)	10.10 (4.8)	9.44 (6.2)	11.13 (3.6)
Cause-effect task	9.33 (5.3)	12.37 (5.2)	13.63 (3.9)	9.88 (4.9)	12.67 (4.2)	13.78 (3.6)
Overall persistent	8.17 (4.6)	11.62 (4.3)	12.67 (3.5)	8.71 (3.4)	9.21 (4.5)	11.87 (2.8)

T1 = pre-assessment prior to intervention; T2 = assessment post the first intervention; T3 = assessment post the second intervention.

the IAMM tasks and thus reflected in an increase in MM. This was suggested by previous studies that assert that novel features, within the environment, improve children's motivation and in particular MM (Gottfried et al., 1998; Miller and Miller-Kuhaneck, 2006).

It appears that class A, which received the social interventions, had a greater improvement in their MM scores. This might be further supported by the importance of the interaction aspect between caregiver and child. Kelley et al. (2000) reported that supporting children's autonomy, and structuring tasks, maximizes their initiative and fostered feelings of control. As this was implemented, among others, we may speculate that having class A exposed to that first had such a positive influence on the children's MM that continues to improve after the physical modifications were implemented at the second stage. In other words, these findings might imply that having supportive, encouraging and sensitive caregivers who promote children's MM is a necessary initial step in treatment planning for these children. The significant changes in the MM scores at the end of both interventions, especially in the *cause and effect* task, suggest that maybe the combination of the two types of environmental changes may be the best for children with developmental disabilities. Thus, changing the way caregivers interact with the children so as the way they communicate and behave facilitates the children's ability to cope with the presented challenges. In addition, encouraging the children to explore their surrounding by changing it after a thorough physical and accessibility assessment may serve as a valuable addition to further enhance their MM.

Study limitations and recommendations

Because of the small sample size in each of the selected classes, the results of this pilot study should be interpreted with caution. It would be instructive to examine the possible gains in MM of children from different diagnostic subgroups following these forms of environmental intervention.

Conclusion

The study findings, although preliminary, demonstrate the efficiency of providing social and physical environmental interventions to improve children's MM. They support the need to provide such interventions as part

of rehabilitation efforts to optimize the involvement and participation of children with disabilities.

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