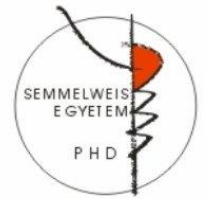
Formal and content-related characteristics of dreaming and their associations with cognitive and emotional development amongst 4-8 year-old children

Doctoral thesis

Sándor Piroska

Semmelweis University

Mental Health Sciences Doctoral School



Supervisor:	Bódizs Róbert, PhD
Opponents:	Kovács Eszter, PhD Michael Schredl, PhD
Review Committee:	Beáta Dávid Pethesné, PhD, habil Pászthy Bea, MD, PhD Balázs Judit, MD, PhD

Budapest

2015

Introduction

REM sleep is associated with vivid oneiric experiences in adults and in verbal aged children. Since REM sleep has a defined developmental pattern from fetal age to adulthood, some authors assume that the case is similar with dreaming as well (Staunton, 2001). Others assume that dreaming is a cognitive achievement dependent on the maturation of the visuospatial fields of the brain, and thus the formation of dreams is impossible for children with underdeveloped visuospatial skills, that is approximately until the age of 2 years (Foulkes, 1982, 1999). In fact the formation and development of human dreaming is still unknown in spite of inspiring results from adult dream research that associates dreaming with emotional and cognitive development as well as neural connectivity (Levin & Nielsen, 2009; Maquet et al., 1996, 2005; Nielsen & Levin, 2007).

REM sleep appears in an early stage of fetal development and undoubtedly plays an important role in the neural maturation in childhood (Jenni & Dahl, 2008). Although, we do not know that REM sleep in infancy is already associated with dreaming or is dreaming a later accomplished skill that develops on the basis of some cognitive and emotional skills, it is evident from research so far that dreaming and dream narratives in children develop parallelly to some cognitive, intellectual and social abilities (Colace, 2010; Foulkes, 1982, 1999).

The major components of the emerging psychological architecture of human have been shown to be characterized by a specific developmental pattern. Thus we could infer that dreaming can be characterized by a specific psychogenesis as well. Results however, are strikingly controversial, even the descriptive level.

While laboratory studies found the dream reports of preschoolers strikingly mundane (lacking movements, actions, an active self-character, human characters, interactions and feelings), a number of other studies, using home or kindergarten settings and morning dream interviews, showed children's dream narratives as being much more similar to those of adults (emotional, eventful, most characters human, frequent interactions, representation of an active self) (Despert, 1949; Honig & Nealis, 2012; Resnick, Stickgold, Rittenhouse, & Hobson, 1994; Sándor, Szakadát, Kertész, & Bódizs, 2015). The significant divergence in the research outcomes is most likely to be the result of

different settings and dream collection methods, which question has long been the topic of passionate debates amongst the dream researchers.

Unfortunately there are no systematic studies investigating the relationship between cognitive abilities and dream reports other than the laboratory studies, which found reliable association between visuo-spatial skills (measured by the Wechsler Intelligence Scale for Children, WISC IV) and dream recall frequency (Foulkes et al., 1990; Foulkes, 1982, 1999). Although direct correlations with cognitive measures were not presented, these studies also reported an age-related improvement in certain features of dream report, like motion imagery, active self-representation, the representation of human characters, interactions and voluntary actions, which also implies a parallel maturation with cognitive skills (Foulkes, 1982, 1999; Strauch & Meier, 1996; Strauch, 2005). Other than the laboratory studies only isolated pieces of evidence can be found that show possible parallel development between characteristics of dream reports and cognitive maturation. Dream bizarreness seems to be the only dream content element that is proved to be correlated with cognitive processes (Colace, 2003).

Frontal cortical areas (especially anterior cingulate and prefrontal areas) that are active during REM sleep are also found to be core supporters of executive attention, measured by the stroop test (van Veen & Carter, 2005). Nightmare sufferers were found to exhibit impaired measures of waking frontal executive functions. They showed a general slowing tendency in the emotional Stroop test compared to healthy subjects (Simor, Pajkossy, Horváth, & Bódizs, 2012). The effectiveness of the executive functions controlled by fronto-cortical areas in lucid dreamers were also shown in a study (Blagrove, Bell, & Wilkinson, 2010), where they found lucid dreamers to have better attention skills and to perform with shorter reaction times in the Stroop test in case of incongruent stimuli. Nightmares tend to engage the dreamer into realistic threatening events typically lacking the dreamer's awareness and leaving the dreamer's self ineffective, unable to control the dream events. On the contrary, lucid dreaming is associated with elevated levels of self-awareness (Voss et al., 2009) and control and higher order cognitive skills (Kahan & LaBerge, 1994). In this view the two phenomena might represent the extremes of self- awareness and effectiveness scale during dreaming, with regular dreams scoring in between the two extremes. It

is hypothesized that attentional skills are required to perform such self-awareness in case of lucid dreamers (Blagrove et al., 2010) and that nightmare sufferers would be characterized by impaired prefrontal and fronto-limbic functions (Simor, Pajkossy, et al., 2012) and finally that in both cases these functions in REM sleep would be reflected in waking neuropsychological tests as well.

Dreaming and REM sleep are also associated with emotional regulation and attachment. In connection with attachment characteristics, an attachment hypothesis has been developed by McNamara (McNamara, Dowdall, & Auerbach, 2002; McNamara, 1996; Zborowski & McNamara, 1998) which concludes that REM sleep and dreams in part may selectively influence and even promote attachment with specific regard to the developing and the insecurely attached human organism.

The basis of attachment theory of dreaming has its roots in common neuro-anatomical systems of attachment, emotional functioning and REM sleep. The REM specific activity practically includes the circuits of fronto-limbic emotional network (including amygdala, orbito-frontal cortex and ventro-medial prefrontal areas) (Steklis & Kling, 1985). In awake functioning limbic structures such as amygdale are correlated with emotional responses especially fear responses (Adolphs, Tranel, Damasio, & Damasio, 1995; Feinstein, Adolphs, Damasio, & Tranel, 2011) and the ventromedial prefrontal cortex is involved in emotion regulation and fear extinction processes (Hänsel & von Känel, 2008; Urry et al., 2006). These results support the psychological models of dreaming that connect dreaming with one's affective experiences and suppose an emotional regulational function of dreams (Cartwright, Luten, Young, Mercer, & Bears, 1998; Cartwright, 2011; Nielsen & Levin, 2007). Importantly, specific dream contents and characteristics have also been associated with the functioning of the above mentioned brain areas. For instance according to Nielsen and Levin's neurocognitive theory, emotionally loaded dreams, especially nightmares can be a consequence of a disruption in the cooperation of the emotionally weighted subcortical areas and prefrontal-cortical areas, which are unable to down-regulate those emotions, resulting in an ineffective emotional regulation (Levin & Nielsen, 2007; Nielsen & Levin, 2007).

Objectives

1. Since the key to the success of laboratory study results lies in its well-controlled methodology, we aim to propose a similarly carefully thought-out and controlled method based on dream collection at home using a longer term data collection period and including 40 children.
2. Our second aim is to give a description of 4-8 years old children's dream characteristics and dream content in a familiar home environment and using a reasonably neutral and controlled method of dream collection.
3. We also aim to explore connections between emotional and cognitive development and dreaming based the finding presented in the introduction.
4. To provide an example for integrating developmental dream studies into existing theories of adult based research.

Methods

Sample

Participants were 40 children and their parents recruited from different schools and kindergartens in Budapest, Hungary**.** We used convenience sampling and snowball sampling as sampling methods in this time and energy demanding study.

The children were between the ages of 4 to 8.5 years (min: 3.8, max: 8.7, mean: 6.3 years, SD: 1.6). In order to detect age related differences in dream content we evenly sorted them into 3 age groups: 14 children (7 females) between the ages 3.8 and 5.5 years (Group1), 12 children (7 females) between the ages of 5.51 and 7 years (Group2), and 14 children (7 females) between the age of 7.01 and 8.5 years (Group3).

Study procedure

An initial interview with both the recruited parents and the children was carried out, where they were informed about the details and schedule of the study.

During the 6 weeks of dream collection period children and their parents visited our laboratory 3 times for the different testing sessions. The first session included the test of intelligence the second session included the

computerized neuropsychological test and on the third occasion the attachment test took place

Methods of dream collection and control

Dreams were obtained from the children upon morning awakenings over a 6 week period of time in form of a structured dream interview conducted by the pre-trained parents. Interviews were carried out within the first 20 minutes of the waking state each morning and were tape recorded in order to allow retrospective control over the conversation.

In order to rule out parental suggestions and waking fantasy penetrations from entering the reports, we introduced a 3 step control system:

1. The parents were asked to rate the dream reports on a 0-10 scale in order to estimate the extent to which the report is a dream (10) or a product of waking fantasy (0). Dreams rated below 5 points were excluded from the research.
2. A research assistant, blind to the parent's ratings, rated the dreams independently on a similar scale using the guidelines of Colace (Colace, 1998, 2010) on dream report credibility.
3. Answers to suggestive questions were eliminated from the dream narrative.

Measuring instruments

Dream content analysis

After the 6 weeks of data collection, assistants, blind to the purpose of the study, typed the conversations into written documents. We developed our content analysis system on the basis of two already existing systems. One of these existing content analysis methods for children's dreams was developed by Foulkes and Shepherd (Foulkes & Shepherd, 1971) and the other one was the widely used system of Hall and Van de Castle (Hall & Van de Castle, 1966), which we simplified to fit the characteristics of the often short and simple dream reports of children.

Intelligence

We used three subtests from the *Wechsler Intelligence Scale for Children* (WISC-IV) (Wechsler, 2003); the Vocabulary subtest for

assessing verbal abilities, the Digit Span subtest for assessing working memory capacity and the Block Design subtest for estimating visuo-spatial abilities.

Raven's Colored Progressive Matrices (CPM, Raven, Court, & Raven, 1995) were used to assess fluid intelligence based on non-verbal reasoning.

Executive functioning

The relatively recent but well studied *child Attention Network Test* (child ANT, Fan et al., 2002; Rueda et al., 2004) was used to measure reaction times and precision in different components of attention: the alerting, orienting and conflict networks.

Modified Fruit Stroop and Emotional Stroop tests for children were used to measure inhibitory control (Archibald & Kerns, 1999) and emotional interference control (Eschenbeck, Kohlmann, Heim-Dreger, Koller D., & Leser, 2004), dimensions of executive functioning in a situation of interfering stimuli.

Emotional development

The *Manchester Child Attachment Story Task* (MCAST, Green et al., 2000) was used to assess the children's attachment representations in connection with the primary caregiver figure.

The *Strengths and difficulties questionnaire* (SDQ, R. Goodman, 2001) is a short questionnaire completed by the parents, suitable for screening childhood behavioral problems and emotional coping.

Statistical analysis

Since the number of observations (dreams) per child varied greatly across the sample, dream content characteristics were relativized (average item/dream) for each child. These were the units of the statistical analyses. Since the dream related variables did not meet the conditions for parametric testing, we used non-parametric statistics through the main data analysis sections (Kruskal-Wallis test, Mann-Whitney U test, Kendall tau).

Results

Descriptive analysis of dream content throughout the age groups

Dream report frequency and length

Over the 1680 attempts (42 mornings for each of the 40 children) 349 dreams were collected, with an overall mean of 8.7 dreams per child (ranging from 1 to 25 dreams). Group 1 accounted for 112 dreams with an average of 8 dreams per child. Children in Group 2 reported 129 dreams with an average of 10.8 dreams per child, and Group 3 subjects collected 108 with an average of 7.7 dreams per child. There was no significant correlation between dream report rate and age nor significant difference amongst the three groups (Kruskal-Wallis $H = 1.09$, $p = .58$).

The mean length dreams was 38.1 words in Group 1 (median: 32.2), 58.4 words in Group 2 (median: 60.8) and 58.5 words in Group 3 (median: 43.5). We found significant differences between the dream lengths of the age groups (Kruskal-Wallis $H = 6.04$, $p = .048$), with the significant difference observed between Group 1 and Group 2 (Mann-Whitney $U = 31$, $p = .007$, $r = .53$).

Dream characters

Altogether we counted 1092 characters in the 349 dreams, an average of 3.13 characters per dream (not including the self). The most frequent characters in the dreams were human characters, with an average of 2.15 per dream (749 altogether) accounting for 68.6% of all characters. Only 7.9% of the characters were animals. The average number of characters did not show a significant change across the age groups (3.3; 2.8; 3.5 respectively), nor did the percentage of human (71%, 68%, 68% respectively), or animal characters (9%, 6%, 14% respectively) to all reported characters.

Kinematic imagery and dream activities

86% of all dreams were kinematic out of those dreams where kinematic or static nature was explicitly reported by the dreamer. The kinematic or static nature of the dreams was reported in 84% of all dream reports (293 dreams), and this ratio did not differ significantly between the age groups (82%, 81%, 89% respectively).

As further evidence adding to the self-reported kinematic nature of the dreams, we counted self-initiated actions in the dream reports. We counted 1651 activities in the 349 dreams altogether, which on average is 4.73 activities per dream. The number of all activities tended to increase across the age groups (Kruskal-Wallis, $H = 5.51$, $p = .063$). This increase was significant between Groups 1 and 2 ($U = 42$, $p = .033$, $r = .34$). The ratio of dreams containing activities is similarly high and stable across the age groups.

Social interactions

We counted altogether 321 interactions in the 349 dreams which make up an average of 0.92 interactions per dream. 57.1% of all dreams contained at least one interaction. Aggression accounted for 38.3%, friendliness for 45.8% of all interactions. Out of all the dreams 27.7% contained any kind of aggression and 35% involved friendly interactions. The number of interactions per dream (1, 0.8, 1) and the percentage of dreams with at least one interaction (55%, 54%, 62%) remained stable across the age groups.

Self-agency

We considered the ratio of dreams with an active self, the number of dreamer involved successes and strivings per dreams and self-negativity index to be measures of self-agency. The dreamer's own self appeared in an active role in 77.6% of the dreams, which did not differ significantly between the age groups. Analyzing the differences between the age groups a tendency of growth is observable between Groups 1 and 2 ($U = 52$, $p = .097$).

The number of dreamer involved successes was 0.22 per dream on average, which did not change significantly throughout the age groups. Dreamer involved strivings showed an overall tendentious increase with age (Kruskal-Wallis $H = 5.6$, $p = .06$, $df. = 2$) which reached significance in between Group 1 and 2 (Mann Whitney $U = 163$, $p = .018$, $r = .37$).

Cognitions

Verbs reflecting cognitive activities were counted throughout the dream reports in order to test the parallelism of wakeful cognitive skills and dream narratives. The overall frequency of cognitive verbs in the dream reports was .37 and 28% of the dreams contained at least one cognitive

verb. We found a significant increase of cognitions between Groups 1 and 3 (Mann Whitney U = 50, p = .028, r = .42, df= 26) and a tendency between Groups 1 and 2 (Mann Whitney U = 50.5, p = .086).

Emotions and emotional dream quality

The overall frequency of emotions appearing in dream reports is 0.85, which means almost one emotion per dream on average and these emotions appear in 64% of the dreams (ratio of dreams with at least one emotion). Importantly, the number of emotions in dreams, the number of dreams with emotions as well as the relative amount of specific emotions are stable across the age groups.

More than half (59%) of the dreams were reported as positive, 27% as negative and 13.5% as neutral. Although there is a slight increase in the number of negative quality dreams (24%, 20%, 38%) and a decrease in the number of positive quality dreams (72%, 59%, 47%) across the age groups, these remain non-significant.

Dream characteristics in association with cognitive development

Dream recall frequency and report length

The number of recalled dreams per child did not show any significant associations with visuospatial abilities. Similarly, report length did not show associations with either measures of verbal or memory performance. On the contrary report length was associated with the increased accuracy of the Stroop test in case of incongruent stimuli (τ = .25, p = .026).

Human characters, actions, interactions in the dreams

The number of human characters per dreams showed no correlations with the executive measures of neither of the neuropsychological tests. On the contrary we found a positive association with the effectiveness of the orienting network (τ = .23, p = .04) which is an essential measure of the ability to select the relevant stimuli in a distracting environment, thus interpreted as part of the human attention network supporting the executive system.

The number of self-initiated actions per all actions as well as the ratio of gross motor activities in dreams was significantly associated with the incongruency index of the stroop test (τ = .26, p = .02 and τ = .24, p = .03, respectively), indicating a more efficient behavioural inhibitory

control with more dreamer involved actions. In addition, gross-motor activities were associated with higher accuracy in the condition of incongruent stimuli in the stroop test ($\tau = .28$, $p = .01$) indexing better inhibitory control functions.

The number of verbal actions per dreams correlated positively with the Vocabulary subtest of the WISC test ($\tau = .24$, $p = .03$).

Interactions and specifically dreamer initiated interactions per dreams were also associated with the behavioural inhibitory control functions measured by the Incongruency index of the Stroop test ($\tau = .23$, $p = .03$, and $\tau = .22$, $p = .04$, respectively). Friendly interactions per dreams showed association with the Emotional interference index of the Stroop test ($\tau = .24$, $p = .03$) being positively correlated with a more efficient control of emotional interference.

Dream bizarreness

We found no significant association between bizarre elements in the dreams and measures of intelligence and executive functions. However when we analysed the above relationship without controlling for the effects of age we found comparable results with previous studies (Colace, 2010).

Self-agency and cognitions

We considered the effectiveness of the self and cognitive/metacognitive verbs in the dreams a measure of awareness during dreaming in children. Interestingly, both the ratio of dreams with active self-representation ($\tau = .27$, $p = .03$) and cognitive/metacognitive verbs ($\tau = .25$, $p = .02$) together with the ratio of dreamer involved strivings ($\tau = .24$, $p = .03$) showed an association with increased accuracy in the Stroop test in case of incongruent stimuli. Additionally, dreamer involved success and dreamer involved strivings per dreams were correlated also with the Incongruency Index of the Stroop test ($\tau = .29$, $p = .01$ and $\tau = .25$, $p = .02$ respectively) confirming that self-effectiveness in children's dreams is a correlate of better attentional and behavioural control.

Dream characteristics in relation to attachment, emotional processing

Attachment measures and dreaming

We found higher rates of home setting per all settings ($U = 224$, $p = .048$, $r = .31$, $df = 38$) in the dreams of children categorized as insecurely attached by the MCAST procedure.

On the contrary, securely attached children displayed more exploratory activities ($U = 90$, $p = .027$, $r = -.35$, $df = 38$) and reported less sad emotions ($U = 128$, $p = .01$, $r = .43$, $df = 29$) than insecure children.

Socio-emotional coping (SDQ) and dreaming

The frequency of dream reports were positively correlated to difficulties in emotional coping ($\tau = .32$, $p = .004$) as well as internalizing problems ($\tau = .33$, $p = .003$, $df = 38$). Emotional problems were also correlated with negative dream quality ($\tau = .24$, $p = .041$). Children who experienced more dreams with active self-representation less often expressed both internalizing and externalizing symptoms ($\tau = -.32$, $p = .004$, $df = 38$; $\tau = -.28$, $p = .012$, respectively), similarly to scoring lower on total problem scale of the SDQ.

Conclusions

Contrary to previous laboratory –based research our descriptive analysis of dreaming between 4 and 8 years of age showed young children, especially preschoolers to be more accomplished dreamers than it was previously assumed in the scientific literature. The ratio of active self-representation, kinematic imagery, human characters, actions and interactions, emotions appearing in their dreams were shown to be comparable to those of the adults. On the other hand, our results support previous findings claiming that the formal and content related characteristics of children's dreams (dream length, settings, activities, interactions, self-related strivings, cognitions and bizarreness) show a strong parallel development with age. Preceding research also showed specific dream report characteristics to be related to cognitive development which we not only confirmed but extended the range of studied attributes of dream reports.

In this study we found that longer and more eventful dreams (higher number of actions and interactions per dream) as well as an active role of the dreamer's self in the dream plot (self-initiated actions and active self-representation) indicated a better attentional and frontal executive performance. Character- richness of the dream environment correlated with information selection skills and the emotion-related aspects of the dreams seemed to relate to all the aspects of the attentional network in a positive way.

According to recent findings, patterns of emotional development especially behavioral symptoms and attachment styles are reflected in dreams. We confirm these statements by finding that both insecure attachment and emotional difficulties were associated with negative dream emotions (sadness) and negative dream quality, respectively. According to Nielsen and Levin's neurocognitive theory, emotionally loaded dreams especially nightmares can be a consequence of prefrontal-cortical areas being unable to down-regulate emotions presented by subcortical areas, resulting in ineffective emotional regulation. Our results support this theory, and show that although this theory is often portrayed through the mechanism of nightmare formation, it could be just as relevant as a model in case of dysphoric dreams and in a developmental context.

Finally, we found an association between various aspects of attachment styles and specific attachment related dream content (such as exploratory activity and home settings). Since these findings seem to be reasonably consistent amongst the measured attachment scales of the MCAST, we consider it as evidence supporting the hypothesis of McNamara et al. (Zborowski & McNamara, 1998) suggesting that REM sleep and dreams in part may selectively influence and even promote attachment especially in developing humans.

Importantly, some characteristics of dreams, such as activities and self-agency, emerge as important features possibly reflecting a general positive adaptation and high level of wakeful functioning being correlates of both cognitive and emotional measures of development. Emotional and cognitive functioning are not separable in real life; they are interdependently contributing to a general successful adaptation or a balanced development. This balance could be an important contributor of school performance in this early age, which would be an interesting topic for further research in connection with dreaming.

Our findings provide further support to various theories suggesting a role of dreaming in state-like emotional processing from one day to another and trait-like characteristics of emotional coping and attachment styles. Considering these findings we suggest that working with dreams could be useful in child therapies as well as adult therapies, especially in case of children with emotional difficulties or who have difficulties talking about their life events.

Since in developmental dream research studies are incredibly scarce and most of the modern theories about the possible functions of dreaming are developed and tested only to fit adult populations, this study is an important step to provide tests of these theories in connection with development, thus forming a bridge between the isolated areas of adult and child research. The developmental perspective however can also provide us with useful information about how the levels of cognitive and affective maturation are connected to the development of dreaming as a behavioral output. This might take us closer to understand the role and function of dreaming in cognitive-emotional performance and how dreaming as a phenomenon fits into neural functioning and development.

Publications related to the topic of the dissertation

Sándor P, Szakadát S, Bódizs R (2016) Emotion regulation as reflected in children's dreams – a developmental test of the neurocognitive dream theory, *Mentálhigiéné és Pszichoszomatika* 17:(2) pp. 167-190.

Sándor P., Szakadát, S, Kertész, K. and Bódizs R. (2016). The development of cognitive and emotional processing as reflected in children's dreams: active self in an eventful dream signals better neuropsychological skills. *Dreaming* 26(1) pp. 58-78. IF(2014): 0.6.

Sándor P., Szakadát, S, Kertész, K. and Bódizs R. (2015). Content analysis of 4 to 8 year-old children's dream reports, *Frontiers in Psychology*, accepted for publication, IF (2014): 2.6.

Sándor,P., Szakadát, S. and Bódizs, R. (2014). "Ontogeny of dreaming: A review of empirical studies." *Sleep medicine reviews*, 18: (5) pp. 435-449. IF: 8.5.

Sándor, P., Bódizs, R. (2014). „Gyerekek álmai: módszerek és eredmények a gyerekálmodás kutatásában Freudtól napjainkig – kritikai áttekintés" *Psychiatria Hungarica* 29:(3) pp. 257-272.

Other publications

Ujma P.P., **Sándor P.**, Szakadát S., Gombos F., Bódizs R. (2016) Sleep spindles and intelligence in early childhood – developmental and traitdependent aspects. *Developmental Psychology*. In press. $IF_{(2015)}$: 3.1.

Simor, P., Gombos, F., Szakadát, S., **Sándor, P**., Bódizs, R.. (2015) EEG spectral power in phasic and tonic REM: Different patterns in young adults and children. *Journal of Sleep Research.* 25(3):269-77. IF (2014): 3.3.

Ruggeri, K., Banasik, N., Bock, L., Cosma, A., Ensor, O., Romila, C. I., **Sándor, P.,** Üzümcüoğlu, Y. (2011). An Exploratory Study of Multicultural Education Development in Eastern Europe and Turkey. *Research in Social Change*, 3(2).

Simor P, Köteles F, **Sándor P,** Petke Z, Bódizs R. (2011). Mindfulness and dream quality: The inverse relationship between mindfulness and negative dream affect. *Scandinavian Journal of Psychology* 52:(4) pp. 369-375. IF: 1.5.

Német O., **Sándor P.,** Bódizs R. (2010): Az alvó agy egyedspecifikus vonatkozásai 1. – az intelligencia és az alvó agy, *Hadtudományi Szemle, 3:(2).*

O. Német, **P. Sándor** (2010): A fókusz technika, mint a lelki felkészítés egy lehetséges eszköze a katonai kiképzés során, *Hadtudományi Szemle, 3:(3).*