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Play deprivation decreases adult social behavior

Caroline van den Berg, Jan van Ree and Berry Spruijt

Using EthoVision for Neuroscience Research

The occurrence of social play in a variety of species has since long been recognized as relevant for the development of adult social behaviors. Social play is composed of behavioral patterns related to adult social, sexual and agonistic behavior, although juvenile and adult social behavior differ both in intensity, form and contextual settings. Social play in rats is predominant during a relatively short period of time, starting around day 18 of life, and declines with the approach of sexual maturation. The key element of social play, so called "pinning", follows an inverted U-shaped distribution during development with its peak between weeks 4 and 5 of age. Rearing rats without the opportunity to play results in disturbed social, agonistic and sexual behavior, suggesting that social play is essential for the development of normal social behavior in the rat (Van den Berg et al., 1999).

Research question

We studied the consequences of one or two weeks of social isolation during the play period, followed by different rehousing procedures, on adult social activity. Different rehousing procedures were conducted to investigate whether the previous social experiences (isolated or non-isolated) of the cage mate could influence the isolation-induced social behavioral effects. It has previously been reported that resocialization can reverse changes caused by previous isolation.

Measuring social interactions with EthoVision

Male Wistar rat pups were weaned at the age of 21 days. They were isolated during week 4 and/or week 5. After the isolation period the rats were rehoused in pairs with another rat either with or without an isolation history. Social activity was measured at the age of 12 weeks in an automated social interaction test. The test arena was a circular, black open field (diameter 140 cm) placed in a soundproof room under low light conditions. The social interaction tests consisted of placing one rat that had been isolated and one non-isolated control rat together in the open field. Next, the degree of social interactions was investigated with EthoVision. The two rats, discriminated by apparent size (by painting one rat half black, it appeared to be smaller than the second rat), were tracked using a camera connected to a computer equipped with a frame grabber. The position of both rats was determined every second and the data was stored on disk. Approach and avoidance behaviors were defined on the basis of the direction of movements of both animals and changes in the inter-individual distance. Both animals could be approaching or avoiding at the same time. EthoVision calculates the relative contribution of each animal to a change in positions. The weight attributed to the direction of movement is related to the inter-individual distance: the closer the two animals are, the more important the direction of movement is. The difference between the movements towards each other (approach) and away from each other (avoidance) was calculated and resulted in a net relative movement for both rats towards each other. A positive value is indicative for high social activity and a negative value for low social activity (Spruijt et al., 1992).

The effects of play deprivation

Isolation during weeks 4 and 5 of age caused a reduction of social activity compared to non-isolated controls as shown by a negative net relative movement (figure 1). Previous social experiences of the cage mate (isolated or non-isolated) did not affect this decreased social activity. Isolation during week 4 of age resulted in similar effects, but the reduced social activity was not present when the rats were rehoused with non-isolated rats. Isolation during week 5 of age did not influence social activity patterns in adulthood (Hol et al., 1999).

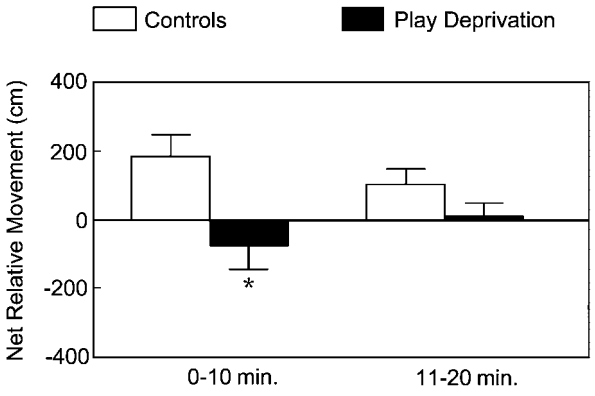

Figure 1. Play deprivation during weeks 4 and 5 of age resulted in decreased adult social behavior (negative net relative movement).

Conclusions

Our findings suggest that there is a sensitive period in infancy for subsequent development of social behavior in the rat. Especially, the acquisition period of social play (week 4 of age) is relevant for further social development. During, but not after, week 5 of age the rats probably have still the abilities to acquire social play. This may explain that social isolation during both weeks 4 and 5 caused rather persistent social deficits independent of subsequent social stimulation.

References

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Contact Information

Rudolf Magnus Institute for Neurosciences, Utrecht University, Utrecht, the Netherlands
E-mail: b.m.spruijt@las.vet.uu.nl