Introduction

In systematic papers on the cichlids of Lake Tanganyika, Allgayer & Collombe (1985) and Poll (1956, 1986) described the small shell-breeding cichlid-fish Lamprologus (Neolamprologus) ocellatus, which lives in the sandy littoral. These fish dig holes around empty snail shells (genus Neothauma). When the shells have been covered with sand so that only the opening is visible, they are used for dwelling and breeding. It is easy to keep and breed L. ocellatus in captivity. There is no difficulty in observing building behaviour, which is induced by placing an empty snail shell on the sand-covered bottom of the tank. This paper attempts to describe the building behaviour and to analyse the reaction-chain. Since the course of building consists of three successive phases we wanted to analyse the releasing factors of the phase transitions also. Therefore, we first attempted to clarify whether onset and end of each individual phase is released and controlled by the performance of the building actions themselves (in the sense of a consummatory act, Lorenz, 1937, 1978), or by the perception of changes in the external stimulus situation resulting from these actions (consummatory stimuli, Hinde, 1966).

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Materials and methods

1. Animals.
The shell-breeding cichlid *Lamprologus ocellatus* lives in the sandy littoral and the sublittoral benthal of Lake Tanganyika down to a depth of about 30 m. The length of the body of an adult male is about 60 mm, that of a female 40 mm. Empty shells belonging to the genus *Neothauma* are inhabited separately by males and females; in either case they are dug into the substrate. The fishes spawn in the shell inhabited by the female. During the first two weeks the female takes care of the young, later the male cares for them. In large tanks, the territories of males comprise an area of 1000 cm². These always include the dwelling-shells of 1-3 females. In the natural habitat, von Drachenfels (pers. information) observed distances of some meters between two or more individuals.

2. General procedures.
The study was carried out on fish from a three-years-old culture. *L. ocellatus* caught in Lake Tanganyika were crossbred twice. All *L. ocellatus* (males and females) in our analysis had the same body length (30 mm). They were tested in the experimental situation at eight-d-intervals. For observation, we used 50 1 tanks with a 9 cm-layer of fine white sand (0.1-0.4 mm grains). The experiment started with the introduction of a fish, taken from a holding-tank. After 30 min of acclimatization a *Neothauma*-shell was placed on the sandy bottom; its orientation was always the same, i.e. opening upwards at an angle of about 45°. Registration was begun when the fish swam to the shell; this usually occurred after a few seconds. The course of building behaviour was assumed to have ended when the shell was entirely covered with sand and no additional construction activities had occurred for a period of 5 min. To guarantee an undisturbed observation, the fish’s behaviour was filmed with a videocamera and simultaneously observed on a TV-screen. In our evaluation the behaviour patterns were registered at two-min-intervals. The statistic evaluation followed Linder (1959), Sachs (1969) and Siegel (1985). Arithmetic means (\( \bar{x} \)) and standard error of the mean (SE) are given.

Seven actions which occurred during the building proceeding were registered; they are described below. The effect of the behaviour pattern—or rather the significance which we attributed to it—is given in brackets.

- **Swimming in (si)** (Fig. 1a): The fish swims into the shell with its head forward, stays inside for few seconds and then exits by swimming backwards. (The inside of the shell is checked).
- **Circling around (ca)** (Fig. 1c): Swimming around the shell in a tight circle. (Inspection of the shell’s exterior, discovering the opening).
- **Turning (tu)** (Fig. 1b): The fish swims to the upper outside edge of the opening, snatches at it and turns the shell around by continuously beating its pectoral- and caudal-fins. (Correction of shell position).
- **Digging (di)** (Fig. 1d): Taking sand from the base of the shell into its mouth and spitting it out at the rim of the pit. (Moving sand away from the shell).
- **Horizontal digging (hd)** (Fig. 1e): Swimming with the mouth open to the base of the shell and causing a current of water—and sand—movement by rapidly moving its pectoral- and caudal-fins. (Moving sand away from the shell).
- **Oversanding (os)** (Fig. 1f): The behaviour-pattern of os is the same as in hd, but the orientation is in the opposite direction, i.e. the fish swims away from the shell by touching the substrate with its mouth and causes a current of water and sand in the direction of the shell. (Moving sand to the shell).