

**Impact of Human and Other Disturbance  
on Behaviour and Heart Rate  
of Incubating Adélie Penguins (*Pygoscelis adeliae*)**

**Supplementary Volume:  
Appendix**

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## Glossary and Definitions

**N.b.:** Terms defined in the context of THIS THESIS are marked with an asterisk (\*). Provision of page numbers directly following a term indicates the whole description to constitute a quotation, *verbatim* or in essence.

**ACCOMMODATION** (OTT 2006, p. 98): the adjustment of the focal length to the distance of objects in the visual field. It is usually achieved by a dynamic change of the total refractive power of the eye.

**ADAPTATION** (BROOM & JOHNSON 2000, p. 175):

1. At the cell and organ level, the waning of a physiological response to a particular condition, including the decline over time in the rate of firing of a nerve cell.
2. At the individual level, the use of regulatory systems, with their behavioural and physiological components, to help an individual to cope with its environmental conditions.
3. In evolutionary biology,  
[a)] any structure, physiological process or behavioural feature that makes an organism better able to survive and to reproduce than other members of the same species.

Also, [b)] the evolutionary process leading to the formation of such a trait.

[angular brackets added by author of THIS THESIS]

**ADRENAL AXES** (BROOM & JOHNSON 2000, p. 95):

1. the sympathetic-adrenal medullary system (principle products: the catecholamines adrenaline = epinephrine and noradrenaline = norepinephrine), and
2. the hypothalamic-pituitary-adrenal cortex system (release of corticotropin releasing factor/hormone in the hypothalamus; CRF/ CRH mediates release of adrenocorticotrophic hormone from the adenohipophysis = anterior pituitary gland; ACTH mediates release of glucocorticoids – cortisol, corticosterone, or both – in the adrenal cortex).

Both systems cause changes in the body which alter the range of substrates available for emergency action: more glucose after adrenomedullary hormones, more amino acids and fatty acids after cortisol. They differ in their time course in that adrenal medulla hormones are shorter-lived than adrenal cortex hormones, and adrenal cortex activity has more long-term effects. Both systems can be activated in beneficial and detrimental circumstances, so care must be taken to consider the context of their activation before deducing that any adverse effect on welfare has occurred.

**AGGRESSION** (SLATER 1999, p. 211): Term describing a loose categorisation of attack and threat behaviour patterns within a species.

**AGGRESSION** (BROOM & JOHNSON 2000, p. 175): A physical act or threat of action by an individual which causes pain or injury or reduces freedom in another individual.

**AGONISTIC BEHAVIOUR** (FRASER & BROOM 1990, p. 385): Any behaviour associated with threat, attack or defence. It includes features of behaviour involving escape or passivity as well as aggression.

**AGONISTIC BEHAVIOUR** (SLATER 1999, p. 211): Behaviour patterns associated with fighting and retreat, such as attack, escape, threat, defence and appeasement. This definition does not exclude interspecific interactions, although the term 'agonistic behaviour' is predominantly used in an intraspecific context.

**AGONISTIC BEHAVIOUR** (BROWN 1964, in TEMBROCK 1982, p. 115): Agonistic behaviour is all behaviour the motivation of which is related to attack, threat or flight. [Agonistisches Verhalten ist alles Verhalten, das in seiner Motivation bezogen ist auf Angriff, Drohen oder Fliehen.]

**AGONISTIC BEHAVIOUR** (TEMBROCK 1982, p. 114f.): Agonistisches Verhalten steht im Dienst der Durchsetzung von Umweltansprüchen in Konkurrenz zu Artgenossen und in einem direkten Bezug zu diesen, durch physische Beeinträchtigung (= aggressives Verhalten), durch

Beeinträchtigung der Verhaltensabläufe bzw. ihrer Funktion, durch Beeinträchtigung von Handlungsbereitschaften (Motivationen).

**ALERT DISTANCE** (TARLOW & BLUMSTEIN 2007, p. 436): The distance at which an animal first orients towards the disturbance stimulus/ the observer. The alert distance illustrates when the disturbance actually begins.

**ALL-OCCURRENCES SAMPLING** (LEHNER 1998 p. 197; in THIS THESIS abbreviated to AOS): All-Occurrences Sampling is one of the sampling methods subsumed under Continuous Recording (q.v.). It serves to record all occurrences of a particular behaviour.

**$\alpha$**  (significance criterion  $\alpha$ ): The significance criterion  $\alpha$  defines the risk of committing a **Type I error** (i.e., the risk of mistakenly rejecting  $H_0$ ). The significance criterion  $\alpha$  is set by the researcher (e.g., at 0.1, 0.05, 0.01, 0.001), conventionally at 0.05, thereby stating that the investigator takes the risk to mistakenly accept the research hypothesis in 5 % of all cases.

**ALTERNATE STARE**: Agonistic behaviour; the bird, either lying or standing, turns its head from side to side staring at the intruder with first one eye, then the other. also see **SIDEWAYS STARE**

**ANARE**: Australian National Antarctic Research Expeditions

**ANIMAL BEHAVIOUR SCIENCE** (CARO 2007, p. 395): Animal behaviour classically encompasses Niko Tinbergen's four questions about behaviour – its development (ontogeny), its causation (physiology, causative mechanism), its function (survival value, adaptive value), and its evolution (phylogeny) [underscored: TINBERGEN'S (1963) terms] – and gives equal weight to each. It investigates hormonal, neural and cognitive mechanisms in adult and young behaviour, as well as its adaptive significance. It uses experiments and observations, but also includes simple descriptive studies. Also see **TINBERGEN'S FOUR QUESTIONS**.

**ANTARCTIC CONVERGENCE** (AINLEY 2002, p. 26; JOYNER 1996, p. 187): Also termed **ANTARCTIC POLAR FRONT**, the Antarctic Convergence is the oceanographic boundary of the Antarctic. It constitutes 'the agreed-upon northern boundary of the Southern Ocean'; and diplomats use it for setting the northernmost jurisdictional reach of 1980 CCAMLR (also see **CCAMLR**). Generally situated between 55°S and 60°S latitude, the Antarctic Convergence is the area in which the colder, denser surface water of the Southern Ocean meets the warmer, less dense surface water of the Subantarctic (temperate) zone.

**ANTARCTIC POLAR FRONT**: see **ANTARCTIC CONVERGENCE**

**ANTARCTIC TREATY** ([www.cia.gov/library/publications/the-world-factbook](http://www.cia.gov/library/publications/the-world-factbook)): Signed in Washington on 1 December 1959, and entered into force on 23 June 1961, the Antarctic Treaty is intended to guarantee the peaceful use of Antarctica and the freedom of research on the basis of international cooperation. In 1991/ 1998, the treaty was supplemented by the **PROTOCOL OF ENVIRONMENTAL PROTECTION** (also see there). In 2004, a permanent Antarctic Treaty Secretariat was established in Buenos Aires, Argentina.

**ANTARCTIC TREATY AREA** (COHEN, H.K. ed. 2002: Handbook of the Antarctic Treaty System, 9<sup>th</sup> ed.): The area to which the provisions of the Antarctic Treaty apply in accordance with Article VI of that Treaty, viz., the area south of 60°S.

**ANTARCTIC TREATY CONSULTATIVE PARTIES** (COHEN, H.K. ed. 2002: Handbook of the Antarctic Treaty System, 9<sup>th</sup> ed.): **ATCP**; the Contracting Parties to the Antarctic Treaty entitled to appoint representatives to participate in the **ANTARCTIC TREATY CONSULTATIVE MEETINGS (ATCM)**.

**ANTARCTIC TREATY SYSTEM** (COHEN, H.K. ed. 2002: Handbook of the Antarctic Treaty System, 9<sup>th</sup> ed.): **ATS**; the Antarctic Treaty, the measures in effect under that treaty, its associated separate international instruments in force and the measures in effect under those instruments.

**AOS**: see **ALL-OCCURRENCES SAMPLING**

**ASMA**: Antarctic Specially Managed Area

**ASOC**: Antarctic and Southern Ocean Coalition

**ASPA**: Antarctic Specially Protected Area

- AST:** see ALTERNATE STARE
- AT:** see ANTARCTIC TREATY
- AT AREA:** see ANTARCTIC TREATY AREA
- ATCM:** see ANTARCTIC TREATY CONSULTATIVE PARTIES
- ATCP:** see ANTARCTIC TREATY CONSULTATIVE PARTIES
- ATME:** Antarctic Treaty Meeting of Experts
- ATS:** see ANTARCTIC TREATY SYSTEM
- ATT:** Australian Antarctic Territory; an area which holds about 27 % of the total population of Adélie penguins.
- ATTENTION** (SLATER 1999, p. 212): State in which an animal is more responsive to one aspect of its environment than to others.
- AVERSIVE** (BROOM & JOHNSON 2000, p. 175): Causing avoidance or withdrawal.
- AWARENESS** (GRIFFIN 2000, p. 889): Awareness means subjective, mental experiences such as thinking about some object or event or feeling emotions such as anger, fear or affection. GRIFFIN explicitly states, that he uses the words 'conscious' and 'aware' interchangeably.
- BEATS-PER-MINUTE (bpm):** measuring unit for heart rate. Counting periods of different length, results are rendered comparable by presenting them as number of beats per minute. Depending on original length of counting period, a more or less critical bias is built into this system. As a rule of thumb, periods should not be shorter than 15 s (preferably 20 s).
- BEHAVIOUR s.l.\*:** In THIS THESIS, behaviour s.l. comprises behaviour and posture.
- BEHAVIOUR s.s.\*:** In THIS THESIS, behaviour s.s. refers to behaviour excluding posture.
- BEHAVIOUR SYSTEMS:** In comparative ethology, behaviour systems constitute comprehensive behaviour categories which subsume behaviours based on the same or similar motivation(s) (= motivational systems; originally named 'Funktionskreise' by J. v. UEXKÜLL, 1921). Also see FUNCTIONAL SYSTEMS.
- BEHAVIOURAL ECOLOGY** (CARO 2007, p. 395): "Behavioural ecology is a discipline centred on functional and evolutionary questions about behaviour and morphology. It tries to interpret behaviour in an ecological and phylogenetic context. It has a strong theoretical framework based on game theory, optimality trade-offs and kin selection, and uses elegant experiments and long-term demographic data sets." Also see ANIMAL BEHAVIOUR SCIENCE, CONSERVATION BEHAVIOUR.
- β** (criterion β): The criterion β represents the risk of committing a **Type II error**, viz., the risk of mistakenly rejecting the research hypothesis (or, inversely stated, of mistakenly failing to reject  $H_0$ ). β is conventionally set at 0.20, in which case the investigator declares that they are willing to mistakenly reject their own research hypothesis in 20 % of all cases.
- BILL-JOUSTING:** Agonistic behaviour; **bill-jousting** behaviour occurs especially between birds on adjacent nests: Two neighbours take a firm stand on their nests and face each other, head forward and bill open. Each sporadically tries to grab the adversary's bill with its own and twist it. Also called TÊTE-À-TÊTE.
- BILL-TO-AXILLA:** Agonistic behaviour; in the BILL-TO-AXILLA (BTA) attitude, the penguin puts its bill under one wing and grunts while whirling its head.
- BIOTAS:** Biological Investigations of Terrestrial Antarctic Systems, a SCAR research programme.
- BPM:** see BEATS-PER-MINUTE
- BRADYCARDIA** (WEBSTER'S Comprehensive Dictionary, p. 161): [Abnormal] slowness of the heartbeat. Also see TACHYCARDIA.
- BREEDING GROUP:** see COLONY
- BTA:** see BILL-TO-AXILLA
- C:** see CHARGE
- CAMP:** Conservation Assessment and Management Plan

- CATEGORY\***: In THIS THESIS, the term category refers to a unit used in classification. In chapter 5.3.3, the PARAMETER (q.v.) heart rate, e.g., is assigned to three categories, viz., below, within, and above resting heart rate  $\pm 2$  SD.
- CAUSAL FACTORS** (BROOM & JOHNSON 2000, p. 175): The inputs to the decision-making system, each of which is an interpretation of an external change or an internal state of the body. The internal state includes that of systems in the brain as well as of other body systems. Also see MOTIVATIONAL STATE.
- CBSP**: see CONSERVATION BREEDING SPECIALIST GROUP
- CCAMLR**: see CONVENTION FOR THE CONSERVATION OF ANTARCTIC MARINE LIVING RESOURCES
- CCAS** (HARRIS 1991b, p. 313): Convention for the Conservation of Antarctic Seals, signed 1972, in force since 1978.
- CEE** (COHEN, H.K. ed. 2002: Handbook of the Antarctic Treaty System, 9<sup>th</sup> ed.): Comprehensive Environmental Evaluation; an environmental impact document required for proposed activities that may have more than a minor or transitory impact on the Antarctic environment (from Madrid Protocol, Annex I, Article 3). Also see IEE.
- CEP**: see COMMITTEE FOR ENVIRONMENTAL PROTECTION
- CHARGE**: Agonistic behaviour; the penguin charges the adversary with wings half-opened. Charge is rarely seen in incubating penguins, as the behaviour requires leaving the nest unprotected.
- CHICK** (AINLEY & al. 1983, p. 18): a bird from the time of its complete emergence from the egg until it swam off to sea the first time.
- CHOICE** (KIRKDEN & PAJOR 2006, p. 31): Operational term describing instances of behaviour (e.g., the animal chose to turn right rather than left). Also see PREFERENCE.
- CLUTCH SIZE** (AINLEY & al. 1983, p. 18): Number of eggs laid in one season by an individual female.
- COGNITION** (DAWKINS 1997, p. 62): Cognition refers to the processes by which information is perceived, stored and processed. The term 'cognitive' is used when there is evidence of an internal representation of something in the outside world, which can be used flexibly. Also see CONSCIOUSNESS.
- COGNITION** (DUNCAN 2006, p. 14): Cognition usually refers to mental processes such as perception, memory, learning, computational skills, expectation, etc. In other words, these are processes that have evolved to help the animal deal with the external world in a flexible way. Also see CONSCIOUSNESS.
- COHORT** (AINLEY & al. 1983, p. 18): A group of birds hatched the same season.
- COLONY** (AINLEY 2002, p. 74): A COLONY is an assemblage of nesting Adélie penguins. More specifically, the term colony refers to all Adélie penguins breeding within a 5-nautical-mile (8-km) radius who are strongly related demographically. [...] Within a colony, penguins nest in groups called SUB-COLONIES. Within the groups, TERRITORIES are contiguous. That is, the outer edge of one territory abuts the outer edge of at least one other territory. If it stretches full length, a penguin sitting on its nest can catch and lock its beak with that of its neighbor [sic]; also stretching full length from its nest. A territory within a breeding group might abut as many as six other territories. Formerly, in the case of penguins but not other seabirds, these groups of contiguous territories were called colonies. To prevent confusion, I refer to these groups within a colony as SUB-COLONIES OR BREEDING GROUPS. **N.b.:** Whenever authors use the term ROOKERY, their definition of colony equates AINLEY's definition of subcolonies/ breeding groups! Also see ROOKERY.
- COMFORT MOVEMENTS** (SLATER 1999, p. 212): Varied groups of activities, including grooming, shaking, stretching and yawning.
- COMFORT-SHIFT** (FRASER & BROOM 1990, p. 386): A minor change of posture or position which may briefly interrupt rest.
- COMMISSION FOR THE CONSERVATION OF ANTARCTIC MARINE LIVING RESOURCES**: see CONVENTION FOR THE CONSERVATION OF ANTARCTIC MARINE LIVING RESOURCES.

- COMMITTEE FOR ENVIRONMENTAL PROTECTION** (JOYNER 1996, p. 188f.; Protocol on Environmental Protection to the Antarctic Treaty, Article 11): The CEP is comprised of representatives from all ATCPs and their expert advisors. It gives advice and formulates recommendations to parties regarding implementation of the [MADRID] PROTOCOL [ON ENVIRONMENTAL PROTECTION TO THE ANTARCTIC TREATY] and its annexes. Regrettably, that body is not given any decision-making authority.
- COMPORIMENT\***: In THIS THESIS, the term 'comporiment' is used to jointly refer to focal-animal behaviour, posture, and heart rate.
- CONGENERS**: belonging to the same genus, i.e., *Pygoscelis*. The term is used when referring to Gentoo (*P. papua*) or Chinstrap (*P. antarctica*) penguins.
- CONSERVATION BEHAVIOUR** (BUCHHOLZ 2007, p. 401): Conservation behaviour is a young discipline that investigates how proximate and ultimate aspects of the behaviour of an animal can be of value in preventing the loss of biodiversity. Also see: ANIMAL BEHAVIOUR SCIENCE, BEHAVIOURAL ECOLOGY.
- CONSERVATION BIOLOGY** (CARO 1999, p. 366; 2007, p. 394): Conservation biology originally combined principles of population ecology, population genetics and systematics (traditional and molecular techniques) to study how populations and their habitats respond to anthropogenic change, and now applies this knowledge through protection, restoration and political leverage.
- CONSERVATION BREEDING SPECIALIST GROUP** (ELLIS 1999, p. 163): CBSG; one of the specialist groups within the Species Survival Commissions of the World Conservation Union (IUCN, also see there). The CBSG is the largest specialist group, comprising a network of approx. 800 volunteers with expertise in species' recovery planning, small population biology, reproductive and behavioural biology, wild and captive animal management as well as other disciplines. The CBSG's primary goal is to contribute to the development of holistic and viable conservation strategies. For this, the CBSG has developed a series of innovative tools, models and workshop processes for risk and status assessment and management/ co-ordination of threatened species.
- CONSPECIFICS\***: belonging to the same species, i.e., *Pygoscelis adeliae*. In THIS THESIS, the term is specifically used when referring to Adélie penguins in the vicinity of the study groups.
- CONTINUOUS RECORDING** (LEHNER 1998): Continuous Recording Sampling Methods are used to record a complete account of all behaviour units of interest; i.e. data on occurrence, duration and sequences of both states and events are obtained. These sampling methods provide the most complete and accurate data.
- CONVENTION FOR REGULATION OF ANTARCTIC MINERAL RESOURCE ACTIVITIES** (BECK 1990a, p. 251f.): CRAMRA; the convention was open to signing 1988/ 89, it was signed by several governments (including the UK, the US and the then USSR), but subsequently vetoed by Australia and France for environmental reasons. The MADRID PROTOCOL ON ENVIRONMENTAL PROTECTION TO THE ANTARCTIC TREATY (1991; see there), effectively banned mining and drilling activities for 50 years (until review).
- CONVENTION FOR THE CONSERVATION OF ANTARCTIC MARINE LIVING RESOURCES** (HARRIS 1991b, p. 313; BONNER 1990, p. 391): CCAMLR; signed 1980, in force since 1982. CCAMLR operates through a COMMISSION (known by the same acronym), advised by a scientific committee. The commission can set catch limits (with age or size restrictions), designate protected species, set closed seasons or regulate effort and methods of harvesting.
- COPE** (BROOM & JOHNSON 2000, p. 175): Have control of mental and bodily stability. Lack of control may be short-lived or prolonged. Prolonged failure to be in control of mental and bodily stability leads to reduced fitness (see STRESS).
- COPING** (WECHSLER 1995, p. 124): Coping is a behavioural reaction to aversive situations, i.e., to situations that induce physiological stress reactions. [...] From an evolutionary perspective, aversive situations are likely to result in a reduced fitness if an animal fails to cope (BROOM 1991). [...] The success of the coping behaviour can be measured by its effectiveness in reducing physiological measures of stress or by its effectiveness in removing an aversive situation and thus restoring fitness.

**COPING STRATEGY** (WECHSLER 1995, p. 126): “[...] I attempt to classify these coping responses into four general coping strategies. I suggest that these coping strategies have been shaped by evolution as adaptations to different types of aversive situations with which animals are confronted in a natural environment.” The four strategies WECHSLER distinguishes are

1. escape (increase distance to stimulus → flight behaviour),
2. remove (move stimulus away → aggressive behaviour),
3. search (for an absent stimulus → appetitive behaviour), and
4. wait (for a spontaneous change in the aversive stimulus → apathetic behaviour).

**COPING STYLE** (KOOLHAAS & al. 1999, p. 925): A coping style can be defined as a coherent set of behavioral [sic] and physiological stress responses which is consistent over time and which is characteristic to a certain group of individuals. It seems that coping styles have been shaped by evolution and form general adaptive response patterns in reaction to everyday challenges in the natural habitat.

**CORRELATION** (CRAWLEY 2005, p. 93): Correlation is defined in terms of the variance of x, the variance of y, and the covariance of x and y (the way the two vary together, or the way they co-vary) on the assumption that both variables are normally distributed.

**CR:** see CONTINUOUS RECORDING

**CRAMRA:** see CONVENTION FOR REGULATION OF ANTARCTIC MINERAL RESOURCE ACTIVITIES

**CRÈCHE:** Tech-term for an aggregation of chicks, after the parents have stopped guarding them on the nest. A crèche is defined as three or more chicks closer to one another than half the inter-nest distance (DAVIS 1982, as quoted in AINLEY 2002). In Adélie penguins, crèche size usually ranges from 10 to 20 chicks. Chicks are normally unguarded by adults (SLADEN 1958).

**DATASET\*:** Data obtained for a given group under a specific visiting regime. For groups B and C, the visiting regime was switched after approximately two thirds of the field season so that two datasets exist for each group.

**DIFFERENCE IN MEDIANS\*** (DiM): 1. calculation of median, 2. subtraction; difference in (period) medians is calculated by subtracting the median value obtained for the referential period (e.g., before human visitation) from that of another period (during or after visitation). DiM constitutes the magnitude of responses difference between periods based on median responses calculated across **all subjects per period** (e.g., all focal animals pre-visit vs. during-visit, FAs-X during-visit vs. post-visit). Also see MoD.

**DiM\*:** see DIFFERENCE IN MEDIANS

**DIOPTRE** (MARTIN 1999, p. 445): The power [Breckkraft D] of any optical element may be defined as the reciprocal of its focal length [Brennweite f]; when focal length is in metres, the power is in dioptries.

**DIRECT FITNESS:** see FITNESS

**DISPLACEMENT ACTIVITY** (SLATER 1999, p. 214): Seemingly irrelevant behaviour, such as the grooming or nest building actions sometimes shown by courting or fighting animals.

**DISPLACEMENT ACTIVITY** (BROOM & JOHNSON 2000, p. 175): An activity which is performed in a situation which appears not to be the context in which it would normally occur. Being so dependent for recognition on observer ability to determine relevance to context, the term is of limited use.

**DISPLACEMENT ACTIVITY** (IMMELMANN & BEER 1992, p. 74): An unexpected, seemingly irrelevant movement that occurs out of the behavioral [sic] context to which it is assumed to belong functionally (that is, for which it was presumably evolved). Displacement activity occurs when an ongoing activity is thwarted in some way or when two incompatible tendencies are activated at the same time and hence are in conflict. In such situations the displacement behavior appears to be pointless because it serves neither its own function nor that of the stalled activity.

**DISPLAY** (SPURR 1975b, p. 473; FRASER & BROOM 1990, p. 386): A behaviour feature which may impress or intimidate a partner, rival, or potential attacker. According to SPURR, an act may be

called a display only, if it conveys a signal to another animal and if it seems to be specially adapted for that function.

**ECG**: see ELECTROCARDIOGRAM

**EIA**: Environmental Impact Assessment

**ELECTROCARDIOGRAM** (RANDALL & al. 2002, p. 480): An electrocardiogram represents the summation of the electrical activity in various parts of the heart. The major components of the ECG reflect atrial depolarisation (P), ventricular depolarisation (QRS), and ventricular repolarisation (T). Each PQRST-event represents 'one **heartbeat**'.

**EMOTION** (BROOM 2001, p. 18): An emotion is a physiologically describable electrical and neurochemical state of particular regions of the brain which may result in other changes in the brain, hormone release or other peripheral changes but which need not involve awareness. Also see FEELING.

**ENVIRONMENT** (FRASER & BROOM 1990, p. 387): External influences on the development of behavioural or other biological traits. In this definition, external means outside the system or unit under consideration, not necessarily outside the whole organism.

**ETHOGRAM** (SLATER 1999, p. 214): Inventory, listing and describing all the behaviour patterns shown by a species.

**ETHOGRAM** (BROOM & JOHNSON 2000, p. 176): A detailed description in space and time of each behaviour shown by members of a particular species.

**EVENTS**: Behaviours that happen so suddenly and/or fast that only their occurrence can be meaningfully recorded (e.g., headshakes). A change between states may also constitute an event (e.g., for flying birds: the take-off between sitting/ perching and flying).

**EXPERIENCE** (BROOM & JOHNSON 2000, p. 176): A change in the brain which results from acquiring additional information. The information can originate in the external environment of the individual or within the body, and could result from, for example, sensory input, low oxygen availability, or altered hormone levels in the blood.

**FA\***: see FOCAL ANIMAL

**FEELING** (BROOM 2001, p. 18): A feeling is a brain construct involving at least perceptual awareness which is associated with a life regulating system, is recognisable by the individual when it recurs and may change behaviour or act as a reinforcer in learning. Also see EMOTION.

**FG\***: see FOCAL GROUP

**FITNESS** (ALCOCK 1993, p. 576): A measure of the genes contributed to the next generation by an individual, often stated in terms of the number of surviving offspring produced by the individual.

**DIRECT FITNESS** refers to the genes contributed by an individual via personal reproduction in the bodies of surviving offspring. **INDIRECT FITNESS**, in contrast, refers to the genes contributed by an individual indirectly by helping non-descendant kin, in effect creating relatives that would not have existed without the help of the individual. **INCLUSIVE FITNESS** is the sum of an individual's direct and indirect fitness.

**FISHER'S Z-TRANSFORMATION** (BORTZ 1999, p. 747): Transformation of correlations in so-called Z-values, not to be confused with the z-values of the Standard Normal Distribution.

**FLIGHT-INITIATION DISTANCE** (TARLOW & BLUMSTEIN 2007, p. 434): The distance at which an animal begins to flee. Also see ALERT DISTANCE.

**FOCAL ANIMAL\***: IN THIS THESIS, any penguin on a nest that had at some stage contained an artificial egg (and had thus been marked) was treated as a focal animal.

**FOCAL GROUP\***: IN THIS THESIS, the term '**group**' refers to an area of sub-colony rather than to a definite number of nests. A focal group consisted of the incubating penguins of the first four colony rows visible on the monitor during data transcription. As the focal animals (s.a.) were invariably found in the centre of the video image, the core of each group remained the same

(apart from the fact that there were two penguins to each nest), while those penguins incubating further away from the focal animals were included less frequently.

**FREQUENCY:** Following ALTMANN (1974, pp. 231f.), the term frequency will be used in THIS THESIS to mean *number of occurrences*, in accord with convention in the statistical literature. It has different meanings in some other contexts. Thus 'gene frequency' is used by population geneticists to refer to a relative frequency or *proportion*. In the physical sciences, 'frequency' commonly refers to number of occurrences per second and thus to a *rate*. In some common English expressions (e.g., 'I frequently sunbathe') it seems that the intended meaning is sometimes *percent of time*, and other times *rate*, i.e., number of occurrences per unit of time.

**FUNCTIONAL SYSTEMS** (BROOM & JOHNSON 2000, p. 176): The different sorts of biological activity in the living animal which together make up the life process, such as temperature regulation, feeding and predator avoidance. These functional systems have behavioural and physiological components. Also see BEHAVIOUR SYSTEMS.

**FUNKTIONSKREIS** (TEMBROCK 1982, p. 14): [Aufteilung des Gesamtverhaltens in] "die wesentlichen Funktionseinheiten, über welche der Organismus mit seiner Umwelt 'interagiert' [...]."

**G:** see GAPE

**GAPE:** Agonistic behaviour; the penguin prepares to attack by opening its bill.

**GOSEAC** (BECK 1990b, p. 346): SCAR Group of Specialists on Environmental Affairs and Conservation.

**GROUP\*:** see FOCAL GROUP

**GROUP EFFECT** (FRASER & BROOM 1990, p. 388): An alteration in behaviour within a number of associating animals brought about by common participation. A simple example is **SOCIAL FACILITATION** (also see there), in which there is an increase of an activity merely from the sight or sound (or other form of stimulation) coming from other individuals engaged in the same activity.

**HABITUATION** (BROOM & JOHNSON 2000, p. 177): The waning of an individual's response, which could still be shown, to a constant or repeated stimulus. The process is distinct from fatigue. Also see SENSITISATION.

**HABITUATION** (IMMELMANN & BEER 1989, p. 126f.): Stimulus-specific waning of response; learning not to respond to something on finding that nothing significant is contingent upon its occurrence. More roughly, getting used to something to the extent of ignoring it, getting tired of it, becoming inured to it. [...] Habituation can [...] be viewed as the mirror image of classical conditioning, since it turns an effective stimulus into a neutral stimulus instead of the reverse. Also see SENSITISATION.

**HABITUATION** (McFARLAND 2006, p. 90): An aspect of learning in which repeated applications of a stimulus results in decreased responsiveness. A common feature of habituation is that the habituated response reappears if the stimulus is withheld for a long period of time. Also see SENSITISATION.

**HOLM'S SEQUENTIAL BONFERRONI:** A sequential approach to adjusting the  $\alpha$ -error is suggested by HOLM (1979). It consists of arranging the p-values of the pair-wise tests by size, starting with the lowest value, and then checking these against a series of so-called local  $\alpha$ -error-levels.

**HOLM-BONFERRONI METHOD:** see HOLM'S SEQUENTIAL BONFERRONI

**HOMEOSTASIS** (BROOM & JOHNSON 2000, p. 177): The relatively steady state of a body variable which is maintained by means of physiological or behavioural regulation.

**HORTATORY** (BECK 1994, p. 379): Recommendations can imply various levels of 'strictness'. Hortatory Recommendations should be followed. Also see MANDATORY.

**HPA Axis** (BROOM & JOHNSON 2000, p. 96): hypothalamic-pituitary-adrenal cortex axis

**IAA:** Instituto Antártico Argentino

**IAATO:** International Association of Antarctic Tour Operators

**IEE** (COHEN, H.K. ed. 2002: Handbook of the Antarctic Treaty System, 9<sup>th</sup> ed.): Initial Environmental Evaluation; an environmental impact document required for proposed activities that may have a minor or transitory impact on the Antarctic environment (from Madrid Protocol, Annex I, Article 2). Also see CEE.

**ICSU**: see SCIENTIFIC COMMITTEE ON ANTARCTIC RESEARCH

**IGY**: see INTERNATIONAL GEOPHYSICAL YEAR

**IMMATURE**: see YEARLING

**IMO**: International Maritime Organisation

**INACH** (STONEHOUSE 1992, p. 216): Instituto Antártico Chileno

**INCLUSIVE FITNESS**: see FITNESS

**INCOMPLETE RETURN\***: In THIS STUDY the term 'incomplete return' was used when comportment exhibited post-visit remained altered in the same direction as during visitation, only less so (e.g., strong increase during, lesser increase post).

**INCUBATION PERIOD** (AINLEY & al. 1983, p. 19): The length of time [...] from laying of an egg to complete emergence of a chick.

**INDIRECT FITNESS**: see FITNESS

**INSTANTANEOUS-SCAN SAMPLING** (also termed 'time-sampling' HUTT & HUTT 1970; 'point sampling' DUNBAR 1976; or 'on-the-dot sampling' SLATER 1978)\*: Using Instantaneous/ Scan Sampling the observer scores an animal's behaviour (or the behaviours of several animals) at predetermined 'points' in time. The major benefit of Instantaneous-Scan Sampling is the relative ease of recording data versus All-Occurrences Sampling. According to LEHNER (1998, p. 205), this method works well with behaviour states but is not recommended for use with events. "Instantaneous Sampling can be used to obtain data from a large number of group members by observing each in turn. Moreover, if the behavior [sic] of all visible group (or subgroup) members are [sic] sampled within a very short time period the record approaches a simultaneous sample on all individuals" (ALTMANN 1974, p. 258f.). To emphasise that the data presented in THIS STUDY represent 'truly instantaneous' samples for the entire group, the sampling method is referred to as Instantaneous-Scan Sampling.

**INTENSITY OF COMPORTMENT\***: Relative strength or degree of a quality or force (WEBSTER'S Comprehensive Dictionary 2003, p. 661). A qualitative measure: With respect to within-parameter comparisons, this term is used in THIS THESIS a) when referring to initial differential degrees of expression (e.g., among groups pre-visit), or b) to degrees of changes without specifying exact magnitudinal (q.v.) values (e.g., for different agonistic behaviours: BTA, SST, AST, P, G, C; q.v.). Concerning between-parameter comparisons, resting behaviour is awarded the lowest degree of intensity, while vigilance and particularly agonistic behaviours are considered behaviours of high intensity.

**INTENTION MOVEMENTS** (FRASER & BROOM 1990, p. 388): The preparatory motions that an animal may go through prior to switching to a new behaviour.

**INTENTION MOVEMENTS** (SLATER 1999, p. 216): Movements shown by an animal just before commencing an activity which indicate to an observer what it is likely to do.

**INTERNATIONAL GEOPHYSICAL YEAR** (STONEHOUSE 2000, p. 252): During the first International Geophysical Year (1957/58), the US, the Soviet Union, the seven nations claiming territorial rights in Antarctica, plus Belgium, Japan, and South Africa cooperated effectively in scientific research. The ANTARCTIC TREATY (see there) was drawn up to ensure continuing peaceful scientific cooperation in Antarctica.

**INTERNATIONAL UNION FOR THE CONSERVATION OF NATURE AND NATURAL RESOURCES** (ELLIS 1999, p. 163): a.k.a. WORLD CONSERVATION UNION; the IUCN has six commissions, one of which is the **SPECIES SURVIVAL COMMISSION** (SSC). Within the SSC, there are approx. 100 Specialist Groups, comprised of mainly taxonomically-based groups in addition to five disciplinary specialist groups, one of which is the **CONSERVATION BREEDING SPECIALIST GROUP** (CBSG, see there)

**INTERRUPTIONS\***: In THIS THESIS, interruptions denote stretches of behaviour composed of elements from diverse behaviour systems; interruptions are a behaviour CATEGORY (q.v.). Interruptions were initially differentiated into (and transcribed as) 'within-phase interruptions', 'between-phase interruptions' and 'transitory phases' (also see PHASE), but analysed collectively as 'interruptions s.l.'.

**IPIV\***: see PERFORMANCE INDICATOR VALUES

**ISS\***: see INSTANTANEOUS-SCAN SAMPLING

**IUCN**: see INTERNATIONAL UNION FOR THE CONSERVATION OF NATURE AND NATURAL RESOURCES

**JUVENILE**: see YEARLING

**KYOTO RECOMMENDATION**: see RECOMMENDATION XVIII-1

**L+F\***: loud and fast; visitor conduct

**LEARNING** (BROOM & JOHNSON 2000, p. 177): A change in the brain which results in behaviour being modified as a consequence of information acquired from outside the brain. The modification must last for longer than a few seconds otherwise the effect could simply be a reflex.

**MADRID PROTOCOL ON ENVIRONMENTAL PROTECTION TO THE ANTARCTIC TREATY**: see PROTOCOL ON ENVIRONMENTAL PROTECTION

**MAGNITUDE OF CHANGES IN COMPORIMENT\*** (math.): That which is conceived of as measurable (WEBSTER'S Comprehensive Dictionary 2003, p. 767). A quantitative measure: In THIS THESIS the term is used when referring to measured degrees of differences observed.

**MANDATORY** (BECK 1994, p. 379): Recommendations can imply various levels of 'strictness'. Mandatory Recommendations must be followed. Also see HORTATORY.

**MADRID PROTOCOL**: see PROTOCOL ON ENVIRONMENTAL PROTECTION...

**MARPOL 73/78**: International Convention for the Prevention of Pollution from Ships as amended by its 1978 Protocol (entered into force 1983).

**MEDIAN OF DIFFERENCES\*** (MoD): 1. subtraction, 2. calculation of median; median of (between-period) difference key values are based on between-period differences found **within each session**, i.e. proportions of one period are subtracted from that of another. The median is then calculated across these between-period values. MoD-values thus represent a measurement of **response magnitude** (from pre- to during-visitation) as well as on the magnitude of post-stimulus waning of responses (from during- to post-visitation) observed **in individual sessions**. With respect to differences between pre- and post-visitation, they provide an insight into the extent of recovery found within each session (the smaller the deviation, the greater the similarity between behaviour prior to and after visitation).

**MoD\***: see MEDIAN OF DIFFERENCES

**MOTIVATION** (SLATER 1999, p. 218): Internal changes leading an animal to behave differently at different times.

**MOTIVATION** (BROOM & JOHNSON 2000, p. 177): The system within the brain that induces behavioural and physiological changes, and determines which changes occur and when.

**MOTIVATIONAL STATE** (BROOM & JOHNSON 2000, p. 177): The level of motivation resulting from the combined levels of all causal factors in the brain. Also see CAUSAL FACTOR.

**MOULT**: In penguins, change of the complete set of feathers at the end of the breeding season.

**MYA**: million years ago

**NEED** (BROOM & JOHNSON 2000, p. 177): A requirement, fundamental in the biology of the animal, to obtain a particular resource or respond to a particular environmental or bodily stimulus. To have a 'need' is to have a deficiency which can be remedied by obtaining a specific resource or stimulus.

**OCCUPATION PERIOD** (Ainley 2002, p. 131): During the Adélie penguin breeding cycle, the occupation period includes establishment of territories, pair formation, egg laying and incubation. Also see REOCCUPATION PERIOD

**ONE-ZERO SAMPLING** (also termed 'time-sampling' HUTT & HUTT 1970; or 'Hansen system' FIENBERG 1972, quoted in LEHNER 1998): One-Zero Sampling serves to record whether a behaviour state – or, less frequently, event – occurred (one) or did not occur (zero) during a sample interval delineated by points in time.

**OPERANT CONDITIONING** (ALCOCK 1993, p. 577): A kind of learning, allied with trial-and-error learning, in which an action (or operant) that is rewarded becomes more frequently performed.

**OZS**: see ONE-ZERO SAMPLING

**P**: see POINT

**PAIN** (BROOM 2001, p. 17): Pain is an aversive sensation and feeling associated with actual or potential tissue damage. Also see EMOTION, FEELING

**PARAMETER\***: In THIS THESIS, the term parameter is used to refer to entities which are either 'seamlessly' measured or assigned to categories (also see CATEGORY). Weather parameters, for instance, comprised temperature ('seamlessly' measured in °C), and cloud cover (assigned to four categories of increasing cloudiness). Behaviour parameters (elements and/ or systems, e.g., resting behaviour) were assigned to behaviour categories (category 'rest'). The parameter heart rate was either measured seamlessly (20 s-counts of beats) or assigned to three different CATEGORIES (q.v.).

**'PENGUIN UNIT'-INDEX\*** (PUI): To render focal-group reactions comparable across periods and sessions, as well as between different rows and groups, 'PENGUIN UNIT'-INDICES were calculated. The indices corrected for differences in number of sampling units (points or intervals) and differences in the number of penguins per group (PUI-R) or row (PUI-G), i.e., within groups or rows across different sessions, as well as between different groups or rows. The procedure resulted in values ranging from 0.00 to 1.00, with larger values indicating a greater proportion of penguins assigned to the respective category.

**PERFORMANCE INDICATOR VALUES\*(PIVs)**: During focal-group evaluations, the POINT PERFORMANCE INDICATOR VALUE FOR HUMAN VISITATION (PPIV-H) was used to reflect changes in intensity of human disturbance. It constituted a **weighted** measure, integrating visitor distance, number and conduct at each sampling point. The POINT PERFORMANCE INDICATOR VALUE FOR CONSPECIFIC PRESENCE (PPIV-C) simply reflected changes in total number of conspecifics present at a given sampling point (from 'out' to 'between 4<sup>th</sup> and 5<sup>th</sup> row'). It represented an **unweighted** measure, i.e., conspecific movement and conduct were not taken into account. During evaluations of behaviour elements, posture and heart rate, the focus was on the 'disturbees' (the incubating penguins, i.e. FAs), and transcription of disturbance was adapted to the time frame chosen to analyse the focal animals' comportment (20 s-intervals, primarily opted for due to duration of heart rate counting-intervals). The resulting INTERVAL PERFORMANCE INDICATOR VALUES FOR HUMAN VISITATION (IPIV-H) and CONSPECIFIC DISTURBANCE (IPIV-C) thus constituted measures additionally **weighted** by time of exposure per 20 s-interval. With respect to evaluations concerning focal-animal topography, the VISITING STAGE PERFORMANCE INDICATOR VALUE (VS-PIV) represented the stages of the visit **unweighted** by visitor number or conduct

**PHASE\***: In THIS THESIS, phases (and posture STATES; q.v.) denoted stretches of time distinguishable by display of elements pertaining to the same behaviour system (behaviour) or different heart rate levels in relation to resting heart rate (below, within, and above RHR  $\pm 2$  SD). Phases had a minimum duration (behaviour: 3 s; HR: 20 s) maximum possible duration was limited only by recording time. With respect to behaviour, 'PURE PHASES' were exclusively composed of elements from a single behaviour system, while 'IMPURE PHASES' contained spurious elements from other behaviour systems. 'TRANSITIONARY PHASES' constituted a particular type of INTERRUPTION (q.v.). They occurred in-between phases of two different behaviour systems, with behaviour elements from the two behaviour systems changing every one or two seconds.

**PIV\***: see PERFORMANCE INDICATOR VALUES

**POINT**: Agonistic behaviour; if an intruder comes very close to the penguin, the bill is stretched far forwards, the crest ('crown') is erected and the pupil of the eye is lowered to reveal the white.

**PPIV\***: see PERFORMANCE INDICATOR VALUES

**PREFERENCE** (KIRKDEN & PAJOR 2006, p. 31): The term preference denotes a difference between the strength of motivation to obtain or avoid one resource or stimulus (alternative 1) and the strength of motivation to obtain or avoid another (alternative 2). The alternatives offered can be substitutes (different ways to satisfy the same motivation) or non-substitutes (e.g., food vs. bedding). In the former case, resources are compared, whereas in the latter case, the comparison is between strengths of different motivations. The term preference is distinct from the term CHOICE (see there) in that it describes characteristics of animals (e.g., this animal prefers bananas to oranges).

**PRIMARY DATA TRANSCRIPTION\***: In THIS THESIS, primary data transcription (=data transcription I) comprised transcription of video data into hardcopy matrix.

**PROPENSITY\***: In THIS THESIS, the term propensity is used to denote response readiness, i.e., readiness to respond upon stimulus presentation (reflected in differences between pre- and during-visitation), to cease responding upon stimulus withdrawal (differences between during- and post-visitation), and to continue to respond despite stimulus withdrawal (differences between pre- and post-visitation).

**PROPORTION**: relative frequency

**PROTOCOL ON ENVIRONMENTAL PROTECTION** ([www.cia.gov/library/publications/the-world-factbook](http://www.cia.gov/library/publications/the-world-factbook)): The protocol on Environmental Protection to the Antarctic Treaty of 1991 entered into force in 1998. With its five Annexes it supplements the Antarctic Treaty (of 1959, which entered into force 1961). It forms a comprehensive environmental protection regime for Antarctica. A sixth Annex was added on later. The Annexes concern: 1. environmental impact assessment, 2. conservation of Antarctic flora and fauna, 3. waste disposal and waste management, 4. prevention of marine pollution, 5. area protection and management, and 6. liability arising from environmental emergencies. Also termed MADRID PROTOCOL.

**PUI\***: see 'PENGUIN UNIT'-INDEX

**RATE**: number of occurrences per unit of time

**RECOMMENDATION XVIII-1**: also called KYOTO RECOMMENDATION, TOURISM RECOMMENDATION

**REOCCUPATION PERIOD** (AINLEY 2002, p. 171): Adult Adélie penguins who lose their eggs return to occupy their nest sites at about the time that eggs successfully incubated by other pairs begin to hatch, hence the name reoccupation period for this phase of the breeding cycle. Also see OCCUPATION PERIOD

**REST**: All forms of bodily inactivity. (TEMBROCK 1982, p. 87): "In Anlehnung an HASSENBERG (1965) möchten wir alle Formen der körperlichen Inaktivität als 'Ruhe' bezeichnen."

**RESTING**: Some authors specify a state of 'resting' in which an animal is bodily inactive but wide-awake.

**RESTING HEART RATE\***: In THIS THESIS, between 3 and 10 pre-visit 20 s-values of heart rate obtained during the behaviour system of resting (number of values according to availability) at the beginning of each heart rate record were used to determine mean resting heart rate (RHR) and its standard deviation (SD). Values were considered only, if the 20 s-interval for which the heart rate value had been calculated contained a minimum of 15 s 'at rest'; additionally, resting behaviour had to have been displayed for a minimum of 10 s in the previous 20 s-interval. For heart rate topography, RHR  $\pm 2$  SD created a tolerance band that served to assign heart rate values of the remainder of a given record to three categories (below, within, above RHR  $\pm 2$  SD).

**RHR\***: see RESTING HEART RATE

**RISK-DISTURBANCE HYPOTHESIS** (FRID & DILL 2002, p. 2): The risk-disturbance hypothesis predicts that "responses by disturbed animals track short-term changes in factors characterising disturbance

stimuli, with responses being stronger when perceived risk is greater". The risk-disturbance hypothesis is used to predict reactions of animals to human disturbance.

**ROOKERY** (PENNEY 1968, p. 85; AINLEY 2002, p. 74): A geographical area, usually a portion of an island or peninsula, that contains one or more colonies (groups) of breeding birds and a landing beach or beaches the birds use to reach the nesting areas from the sea. "The term rookery is left over from the heroic period of Antarctic exploration [...], when Antarctic fur seal 'rookeries' were exploited commercially. [...] Penguins are seabirds, and every other seabird species that breeds colonially, as does a penguin, does so in what are called colonies; in other words, a colony is what a colonial breeder nests in. Why should penguins be described differently? To avoid confusion and to encourage comparison of natural history patterns between all seabird species, I use the term COLONY [...]." N.b.: Whenever authors (e.g., PENNEY 1968; see first definition) use the term ROOKERY, their definition of colony equates AINLEY's definition of subcolonies/ breeding groups! Also see COLONY.

**S+S\***: silent and slow; visitor conduct

**SCAR**: see SCIENTIFIC COMMITTEE ON ANTARCTIC RESEARCH

**SCIENTIFIC COMMITTEE ON ANTARCTIC RESEARCH** (STONEHOUSE 2000, p. 253; JOYNER 1996, p. 184): In 1958 the INTERNATIONAL COUNCIL OF SCIENTIFIC UNIONS (ICSU, the driving force behind the INTERNATIONAL GEOPHYSICAL YEAR) set up a Special Committee on Antarctic Research, charged with initiating, promoting and coordinating scientific efforts in the Antarctic region. This quickly became the permanent Scientific Committee on Antarctic Research, which maintains those functions today and has become the principal advisory body on scientific matters to the ANTARCTIC TREATY CONSULTATIVE PARTIES (q.v.).

**SECONDARY DATA TRANSCRIPTION\***: In THIS THESIS, secondary data transcription (= data transcription II) comprised transcription of hardcopy matrix into Excel/ SPSS spreadsheets.

**SENSITISATION** (BROOM & JOHNSON 2000, p. 178): The increase in response to continuing or repeated stimulation. Also see HABITUATION.

**SENSITISATION** (McFARLAND 2006, p. 179): Increase in the probability of a response resulting from repeated presentation of a biologically significant stimulus. The results of sensitisation are easily confused with those of conditioning, but sensitisation occurs in the absence of correlated reinforcement, and is a form of learning more akin to HABITUATION (also see there).

**SEQUENTIAL BONFERRONI ADJUSTMENTS**: see HOLM'S SEQUENTIAL BONFERRONI

**SIDEWAYS STARE**: Agonistic behaviour; the bird, either lying or standing, turns its head sideways and stares with one eye at the intruder. Also see ALTERNATE STARE

**SOCIAL FACILITATION** (FRASER & BROOM 1990, p. 391): Behaviour that is initiated or increased in rate or frequency by the presence of another animal carrying out that behaviour.

**SPECIES SURVIVAL COMMISSION**: see INTERNATIONAL UNION FOR THE CONSERVATION OF NATURE AND NATURAL RESOURCES

**SSC**: see INTERNATIONAL UNION FOR THE CONSERVATION OF NATURE AND NATURAL RESOURCES

**SST**: see SIDEWAYS STARE

**STATE(\*)**: In THIS THESIS, the term state is used in two contexts, the first of which is usually found in ethological literature.

1. In focal-group evaluations, behaviour (and posture) states (a behaviour that can be timed with a stopwatch, e.g., resting; also posture prone or up) were contrasted with behaviour EVENTS (q.v.).
2. Posture STATES were likened to behaviour and heart rate PHASES (q.v.) to denote their generally far longer duration.

**STIMULATION** (BROOM & JOHNSON 2000, p. 178): Factors affecting an individual animal or part of it.

**STIMULUS** (BROOM & JOHNSON 2000, p. 178): An environmental change which excites one or more receptors or other parts of the nervous system of an animal.

**STRESS** (SLATER 1999, p. 221): Physiological state induced in animals by conditions they are unable to tolerate or cope with, such as pain or overcrowding.

**STRESS** (BROOM & JOHNSON 2000, p. 178/ FRASER & BROOM 1990, p. 259): An environmental effect on an individual which overtaxes its control systems and reduces its fitness or appears likely to do so. Fitness reduction involves increased mortality and failure to grow or reproduce. The environmental factors which lead to stress are **STRESSORS**, and the individuals under stress show **STRESS RESPONSES**.

**STRESS\***: IN THIS THESIS, the term **stress** is **defined** neither on an endocrinological nor on a fitness basis but used as a term descriptive of immediate behavioural and/or heart rate responses of the focal animal(s), comparable to SLADEN'S (1958, p. 3) 'nervous strain'. In accordance with this, the term **stressor** is employed to connote the respective agent or activity perceived as the cause of the stress experienced by the focal animal(s).

**STRESSOR**: see **STRESS**

**STRESS RESPONSE**: see **STRESS**

**SUB-COLONY**: see **COLONY**

**SUFFERING** (RUSHEN 1996, p. 1990): Suffering is a mental state, resulting from different emotions, such as fear, pain, or boredom, which have different causes and effects on the animal's behaviour and physiology. What is common is that they are aversive; animals will seek to avoid such experiences.

**SYNTAX\***: Referring to the structural component of comportment; the term 'syntax' in THIS THESIS encompasses the duration and number of phases/ states. If the 'syntax' is altered, this leads to pattern changes in overall topography of comportment (for behaviour, e.g., shorter phases irrespective of contents, i.e., behaviour system) and/or pattern changes within individual comportment parameters (e.g., shorter phases of 'rest').

**TACHYCARDIA** (WEBSTER'S Comprehensive Dictionary 2003, p. 1276): Abnormal rapidity of the heartbeat. Also see **BRADYCARDIA**.

**TERRITORY**: see **COLONY**

**TÊTE-À-TÊTE**: Agonistic behaviour; tête-à-tête behaviour occurs especially between birds on adjacent nests: Two neighbours take a firm stand on their nests and face each other, head forward and bill open. Each sporadically tries to grab the adversary's bill with its own and twist it. It is also called **BILL-JOUSTING**

**TINBERGEN'S FOUR QUESTIONS** (TINBERGEN 1963): Augmenting Huxley's 'three major problems of Biology' by adding ontogeny, TINBERGEN proposed that the following four questions should be studied by ethologists: 1. causation (physiology; causative mechanism); 2. survival value (adaptive value, function); 3. ontogeny (development); and 4. evolution (phylogeny). He (1963, p. 411) "believe[d] with Huxley that it is useful both to distinguish between them and to insist that a comprehensive, coherent science of Ethology has to give equal attention to each of them and to their integration".

**TOPOGRAPHY\***: IN THIS THESIS, the term **TOPOGRAPHY** signifies that changes in the entire 'landscape' of comportment were of interest. Secondary transcriptions of focal-animal recordings focused on duration and distribution of each of the behaviour systems as well as both postures and heart rate, assessing the 'flow' of comportment before, during and after disturbance to examine changes in overall performance. Taking behaviour as an example, 'flow' in this context combines the overall presence and prevalence ('amount'/ extent) of behaviours belonging to a given behaviour system with the duration of phases found within that system as well as capturing changes between different behaviour systems (e.g., comfort 2 min, vigilance 20 s, comfort 10 s, vigilance 5 s) and 'smoothness' of transitions between systems (e.g., instant switches between systems, interruptions of one system by elements pertaining to another system, transitional phases comprising elements of two different systems). Taken together, these are referred to as the animal's **BEHAVIOURAL TOPOGRAPHY**, and visualised as follows: Behaviour systems are coded numerically, with numbers attempting to reflect differences in focus and intensity (from 'none or noncommittal' during resting to 'outward towards a likely threatening stimulus' during offensive

agonistics). If plotted against time, each behaviour system is thus represented by a straight line on a system-specific horizon, while changes are indicated by the line 'jumping' from one horizon to the next. For a graphic example, the reader is invited to peruse the TOPOGRAPHY CHARTS in appendix 5.3.1-1.

**TOPOGRAPHY CHARTS\***: see TOPOGRAPHY

**TOURISM RECOMMENDATION**: see RECOMMENDATION XVIII-1

**TOURISTS** (ENZENBACHER 1992, p. 17): Tourists are defined as visitors who are not affiliated in an official capacity with an established National Antarctic Programme.

**UNEP**: United Nations Environment Programme

**VISUAL ACUITY** (FERNÁNDEZ-JURICIC & al. 2004, p. 31): The minimum angular separation between two points or objects in the visual field that are just perceived as distinct.

**VISUAL FIELD** (FERNÁNDEZ-JURICIC & al. 2004, p. 31): The limits of the space around an animal from which visual information can be obtained.

**VS-PIV**: see PERFORMANCE INDICATOR VALUES

**WELFARE** (BROOM & JOHNSON 2000, p. 178): The state of an individual as regards its attempts to cope with its environment.

**WORLD CONSERVATION UNION**: see INTERNATIONAL UNION FOR THE CONSERVATION OF NATURE AND NATURAL RESOURCES

**YEARLING** (AINLEY & al. 1983, p. 20): In Adélie penguins, a bird in white-chinned plumage, worn from fledging at about ten weeks to about age fifteen months.

**z-TRANSFORMATION** (BORTZ 1999, p. 756): Method used to turn any normal distribution into a Standard Normal Distribution. A value of a given distribution is transformed into a z-value by subtracting from it the means of the given distribution and dividing the result by the distribution's standard deviation. The z-transformed distribution is characterised by a means of 0 (zero) and a standard deviation of 1.

**Z-TRANSFORMATION**: see FISHER'S Z-TRANSFORMATION

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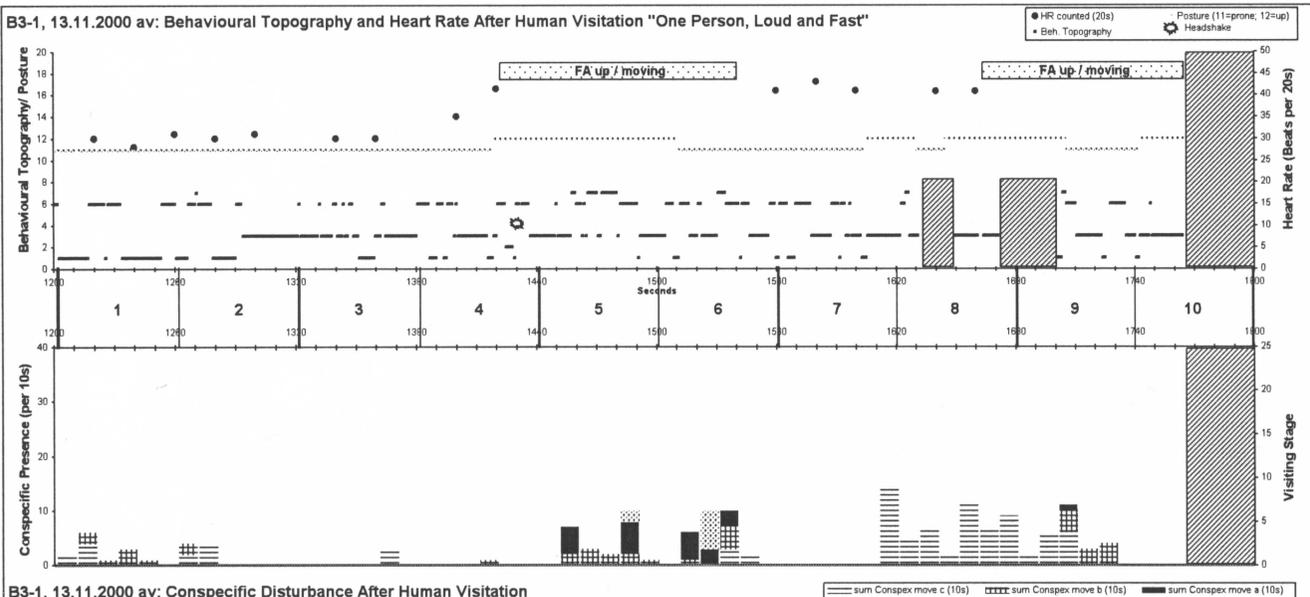
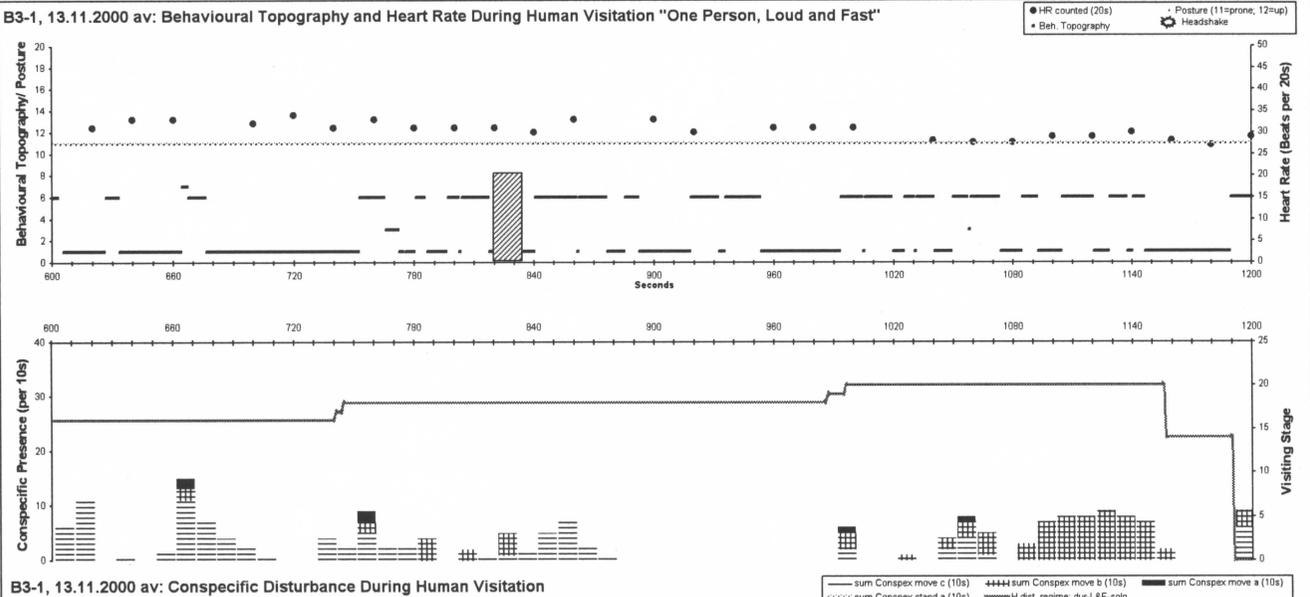
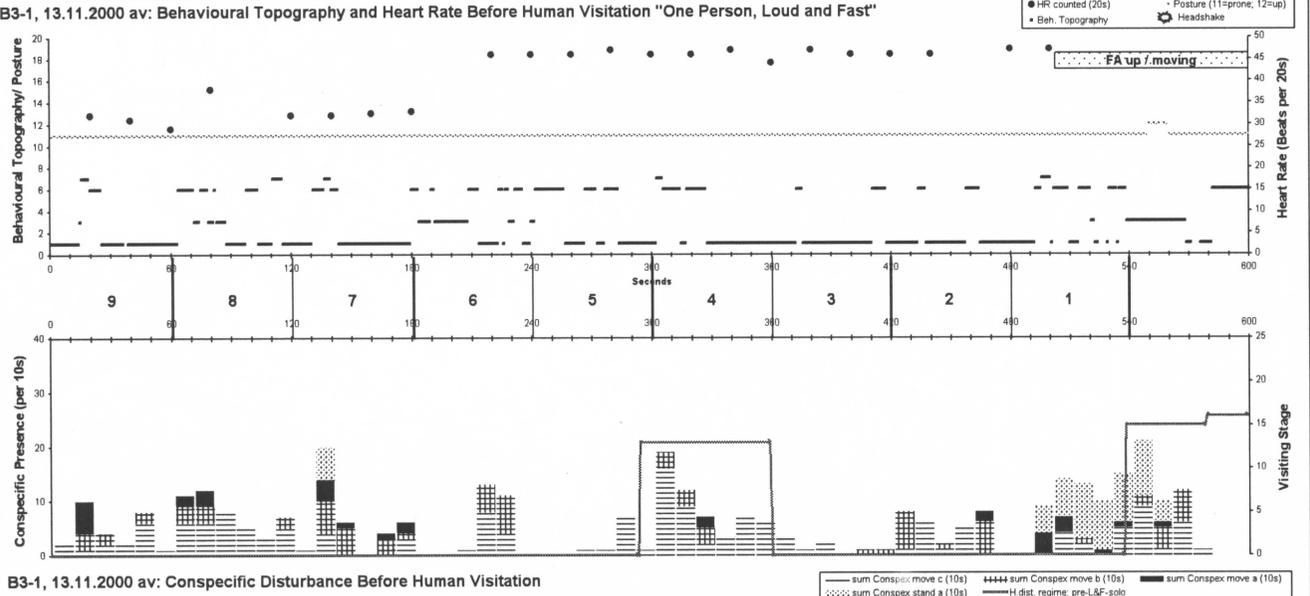
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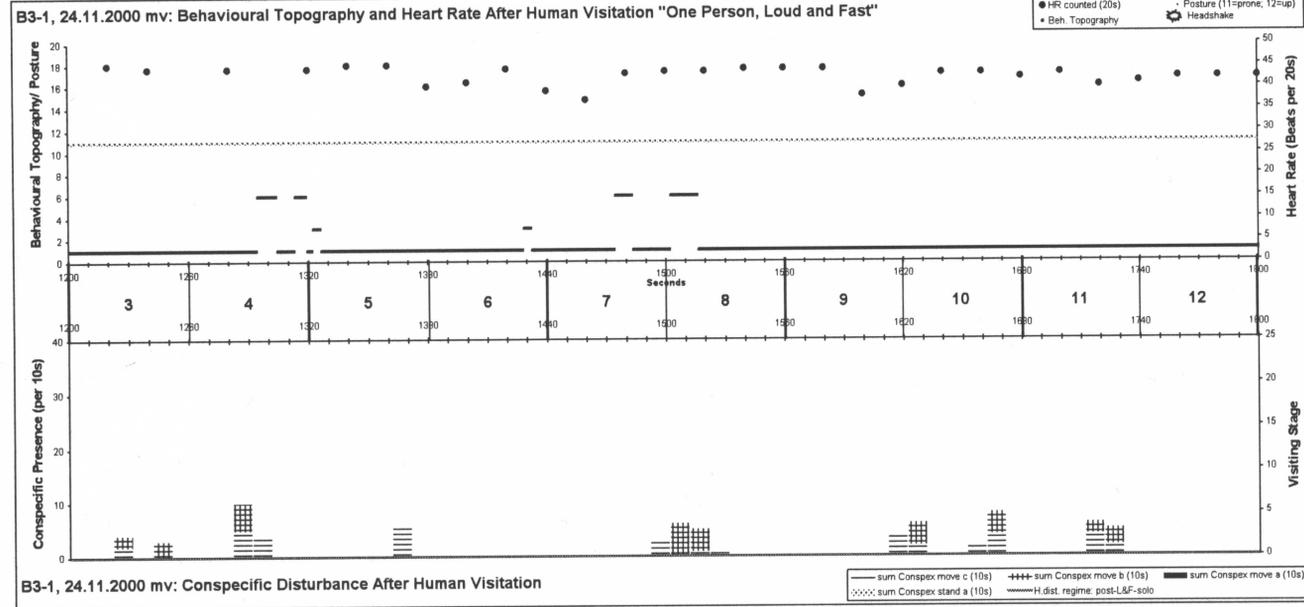
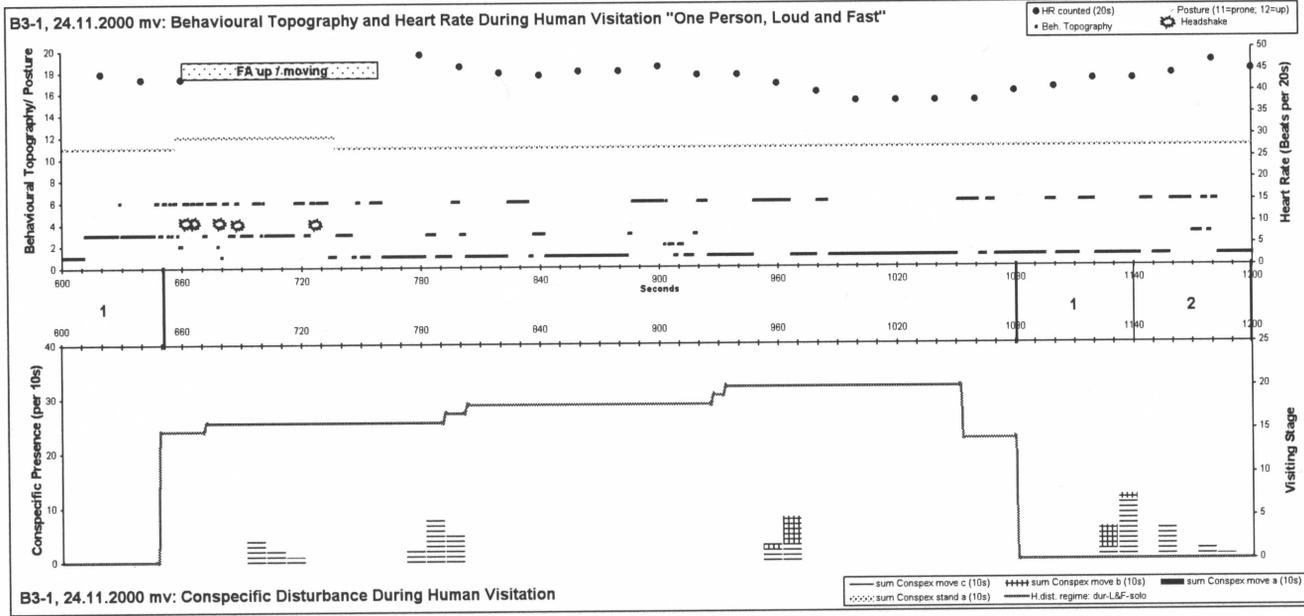
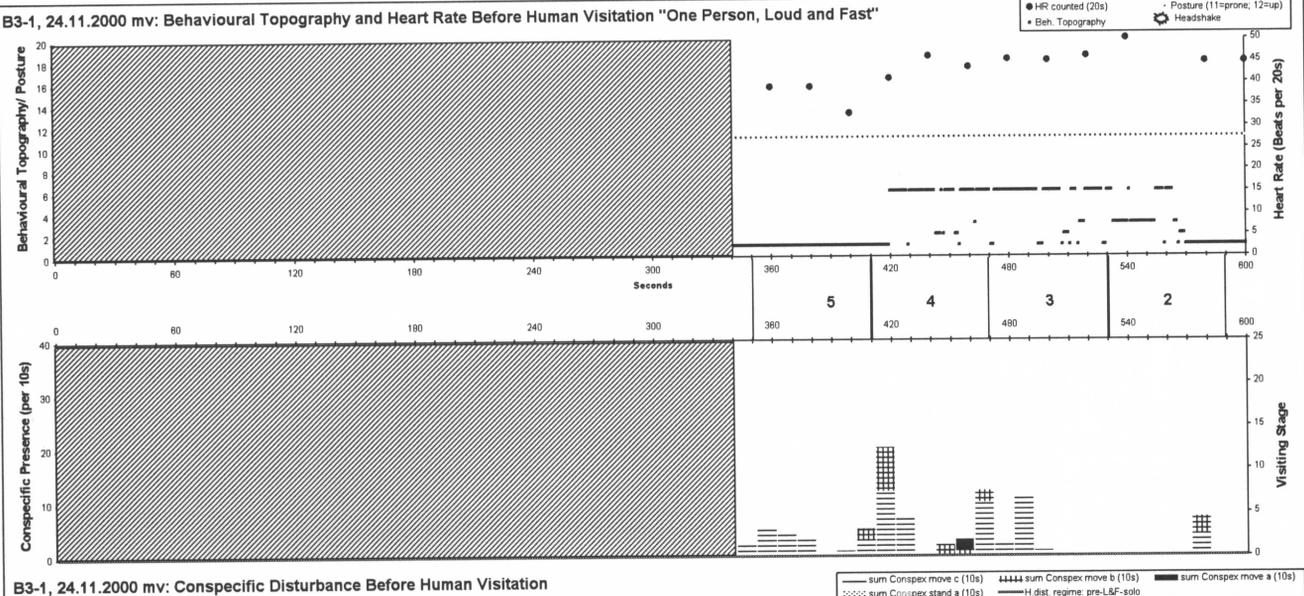
**Appendix 4-4: Exemplary Transcription Sheet of X1-1\_011123\_av.**

See overleaf in Din A3.

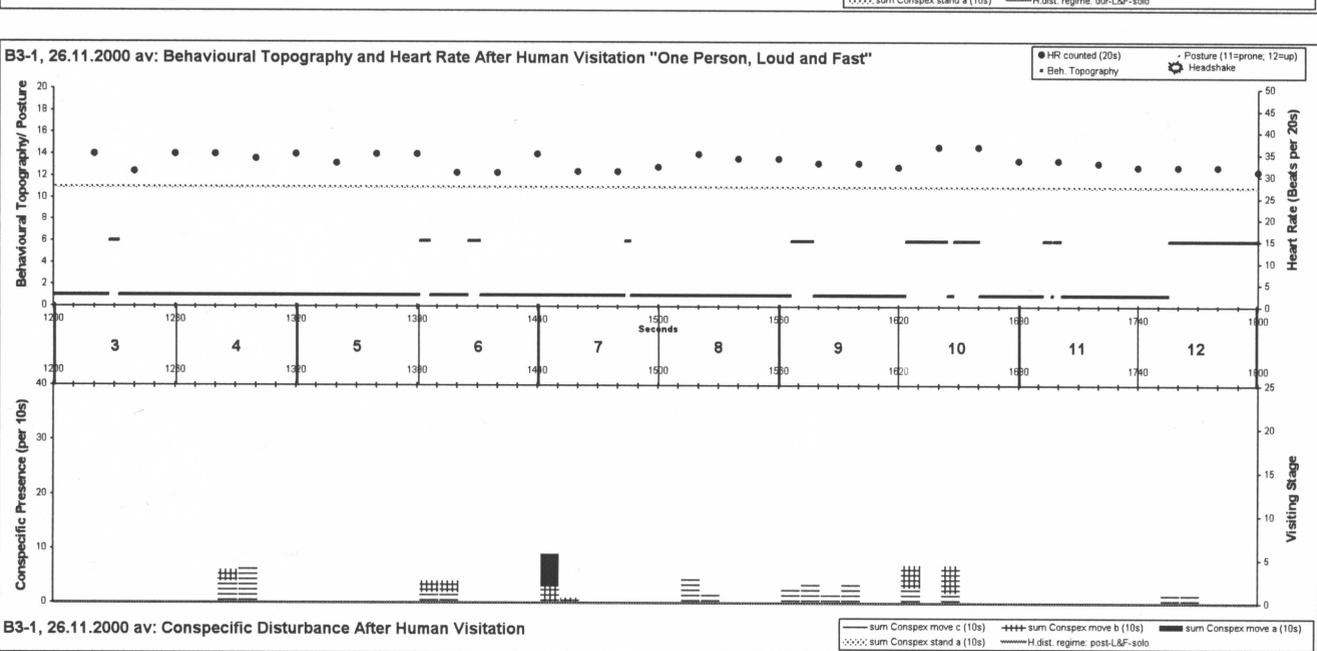
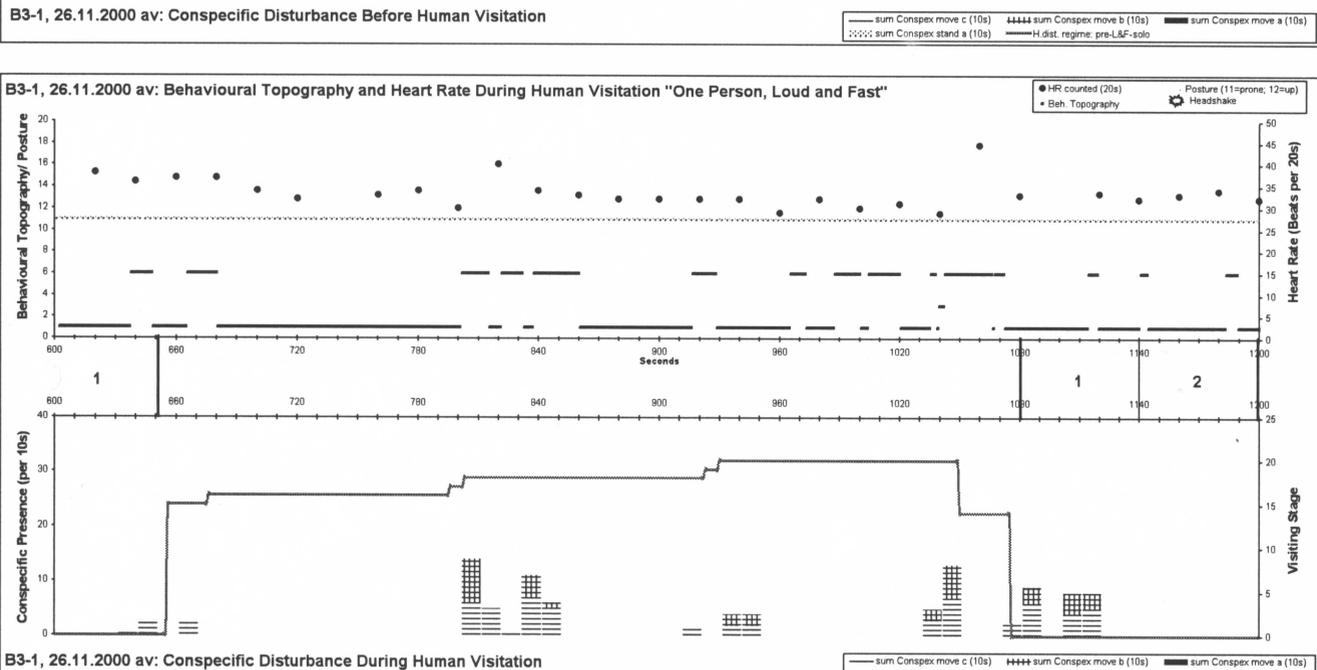
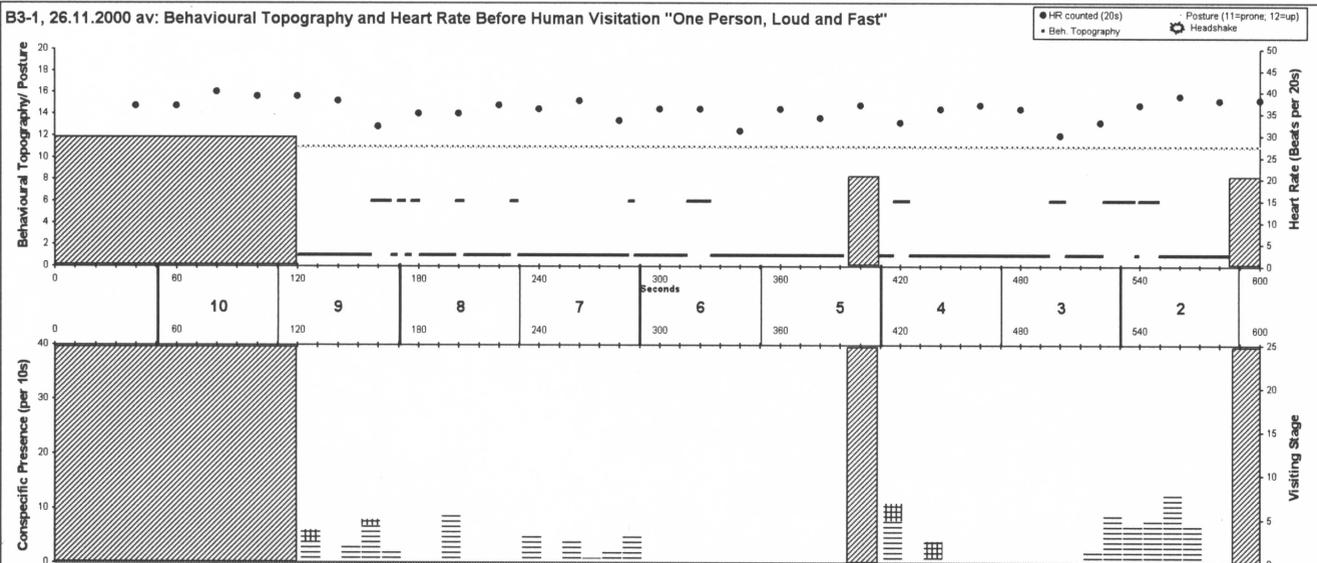


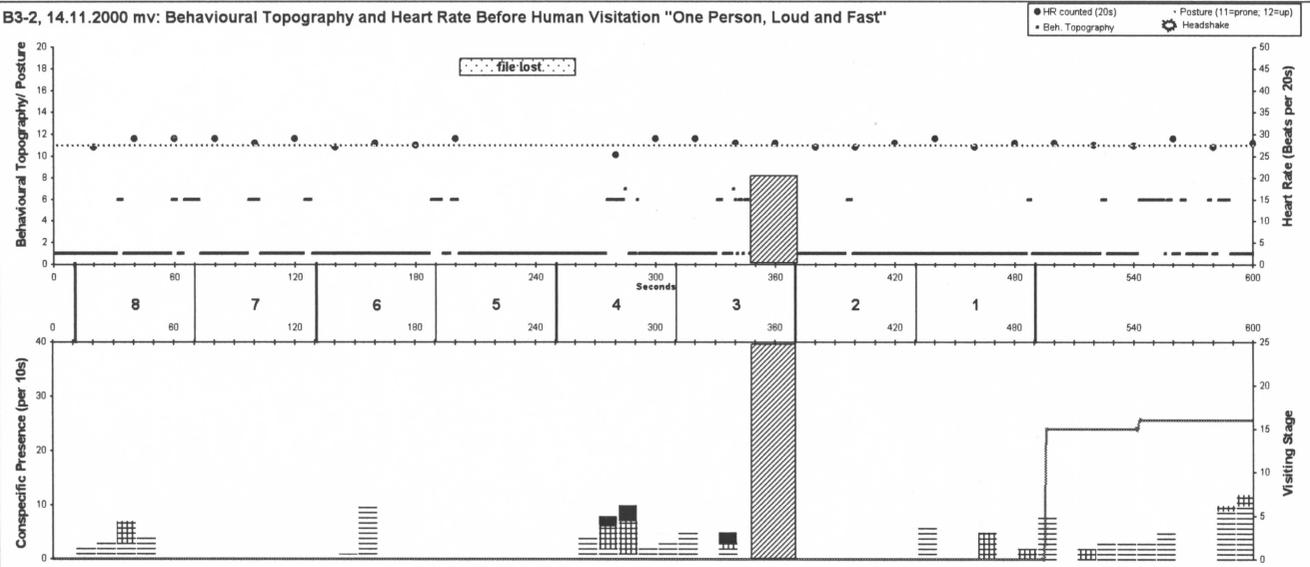
**Appendix 5.3.1-1: Topography Charts (51 pp.).**





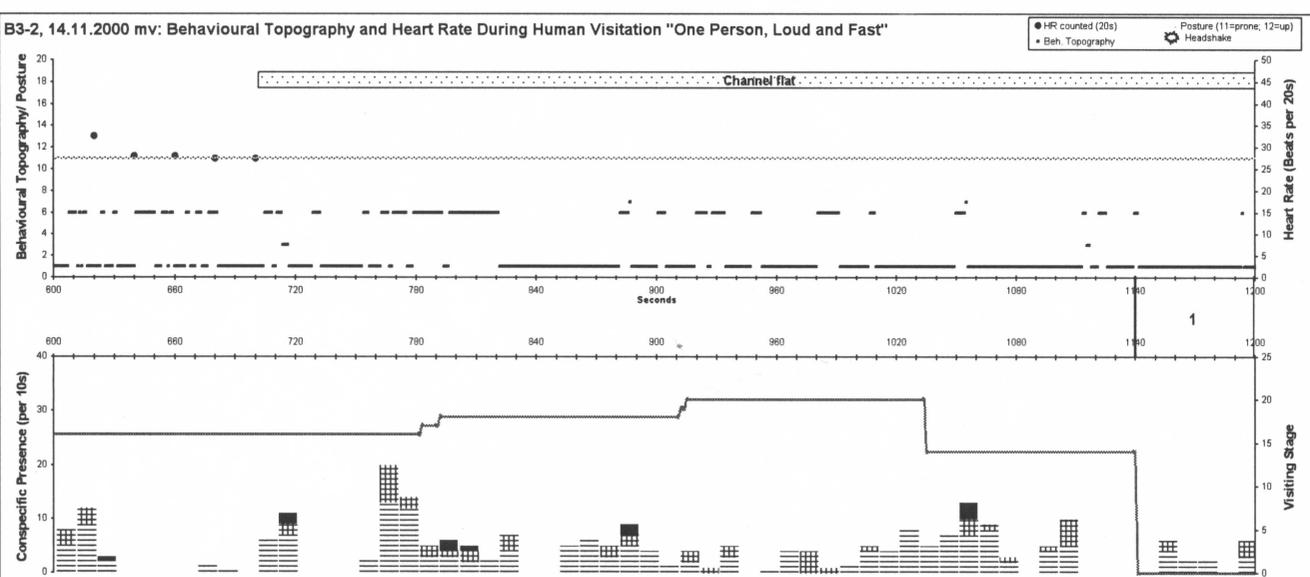
# Behavioural Topography, Heart Rate and Conspecific Disturbance before, during and after Human Visitation





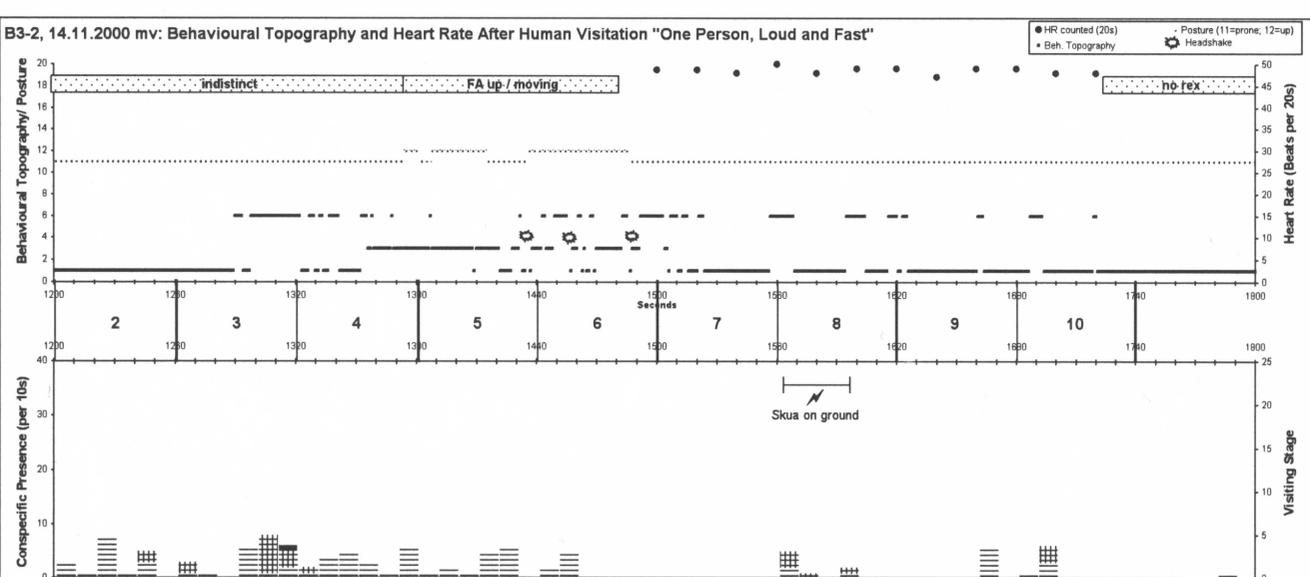
**B3-2, 14.11.2000 mv: Conspecific Disturbance Before Human Visitation**

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⋯ sum Conspec stand a (10s)    — H.dist. regime: pre-L&F-solo



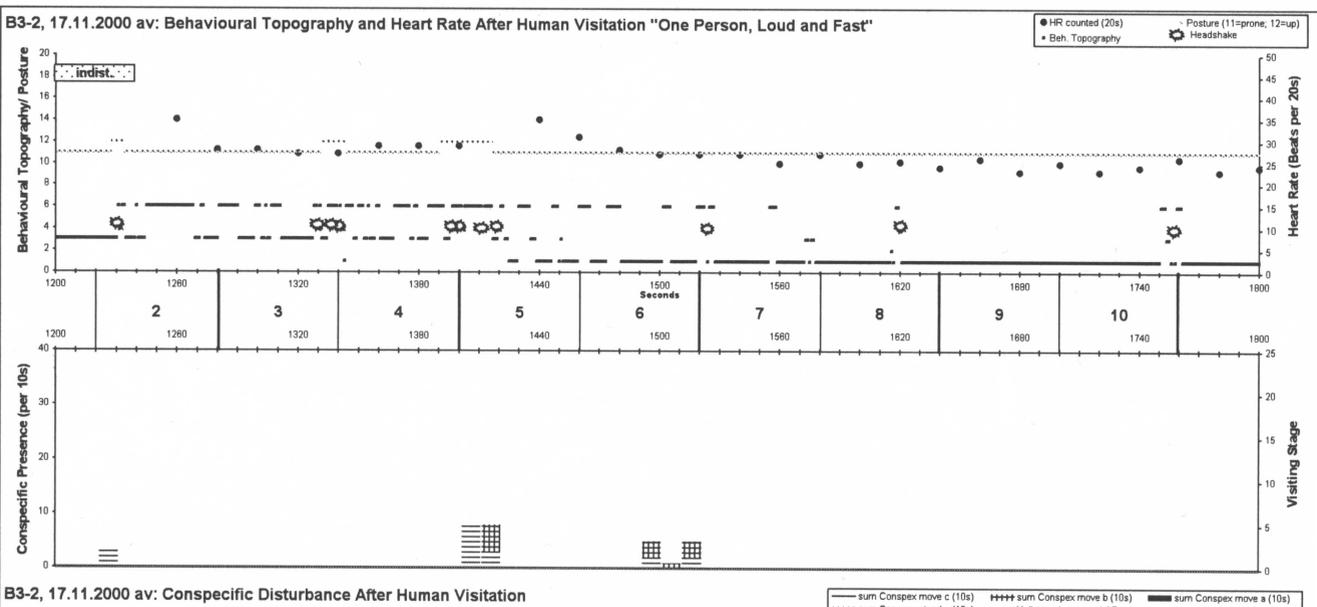
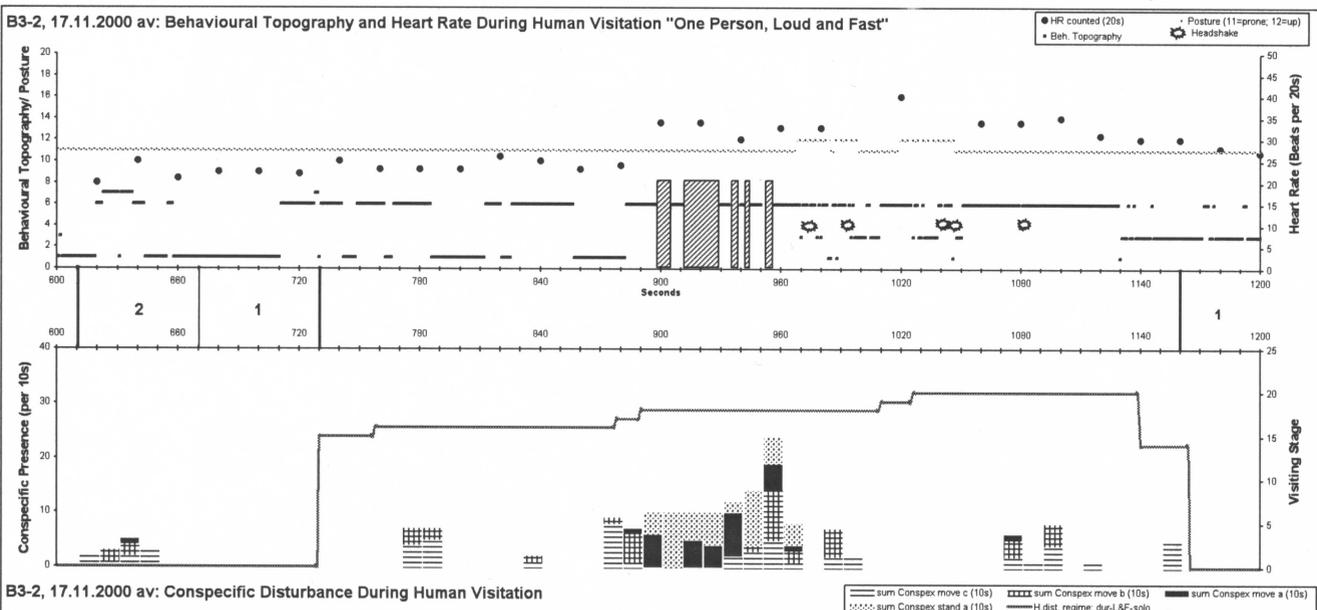
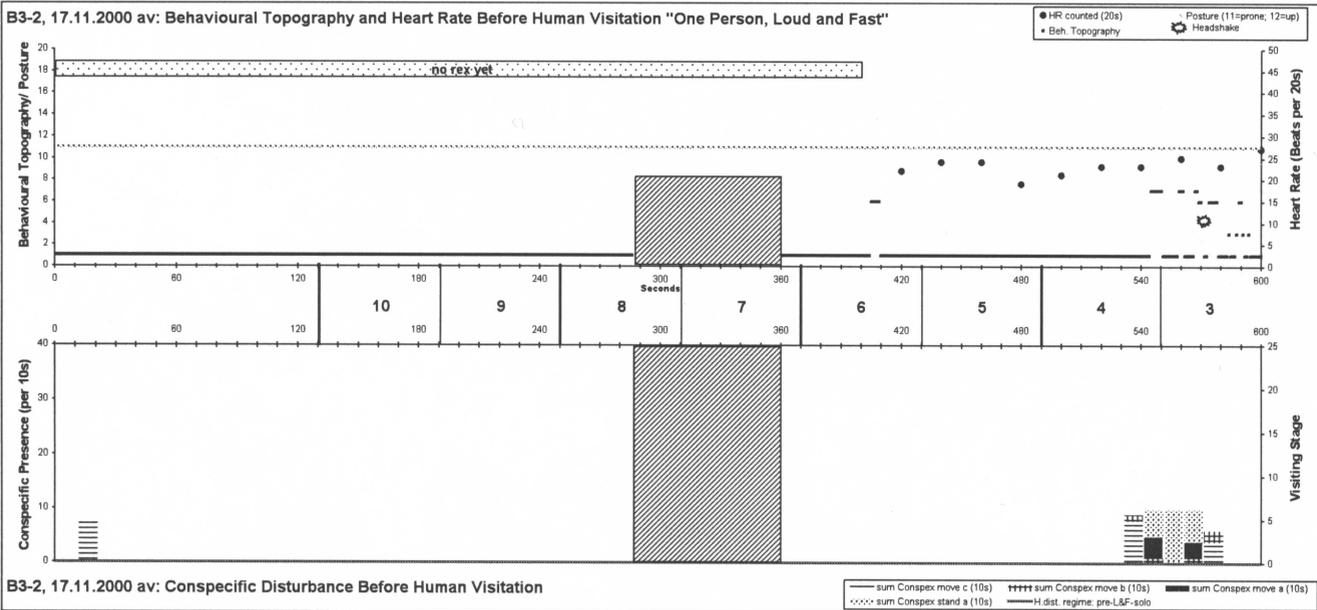
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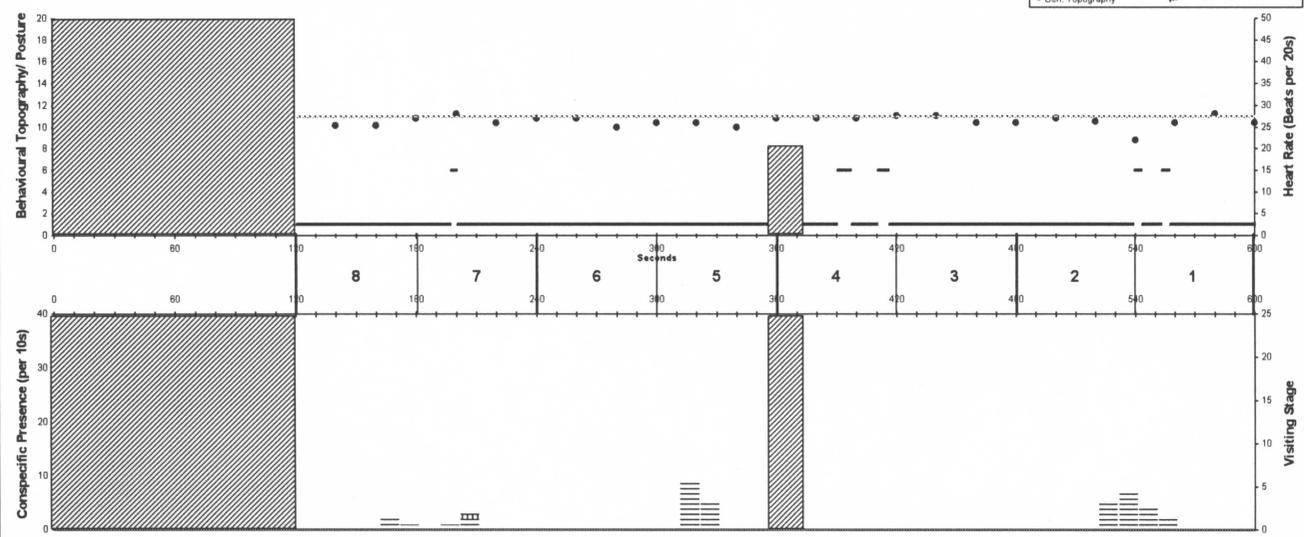


**B3-2, 14.11.2000 mv: Conspecific Disturbance After Human Visitation**

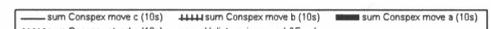
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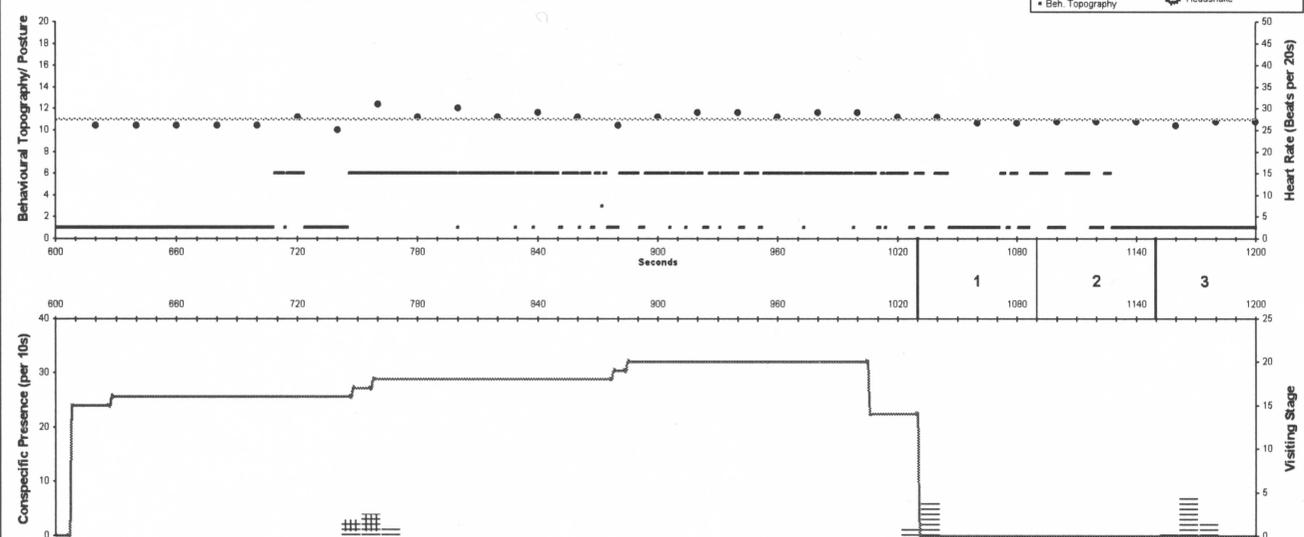
B3-2, 20.11.2000 mv: Behavioural Topography and Heart Rate Before Human Visitation "One Person, Loud and Fast"



B3-2, 20.11.2000 mv: Conspecific Disturbance Before Human Visitation



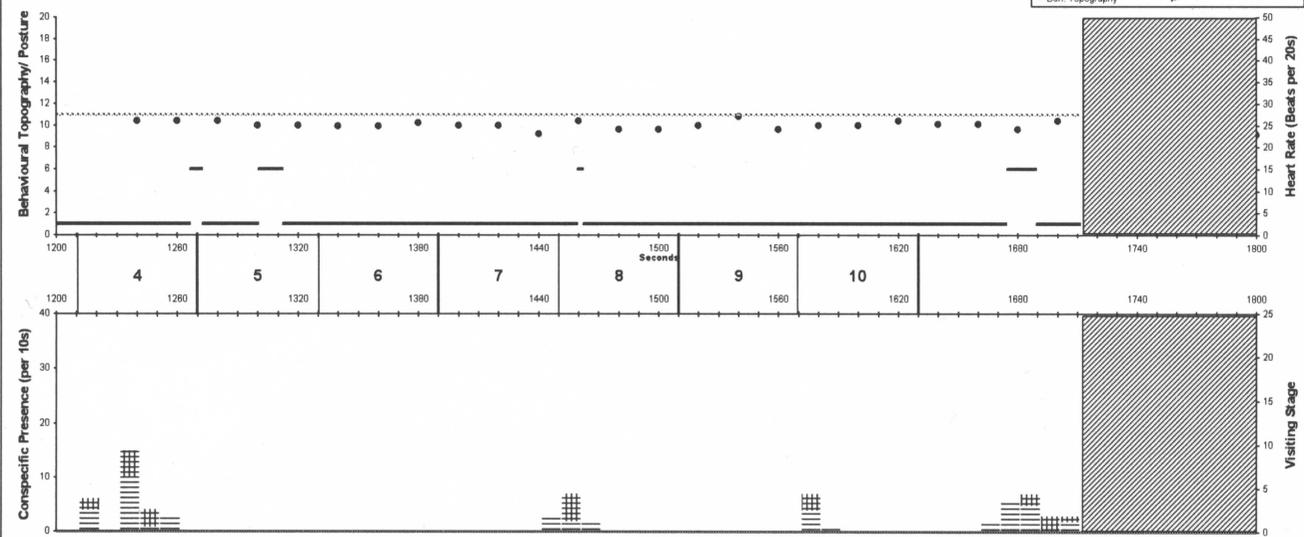
B3-2, 20.11.2000 mv: Behavioural Topography and Heart Rate During Human Visitation "One Person, Loud and Fast"



B3-2, 20.11.2000 mv: Conspecific Disturbance During Human Visitation

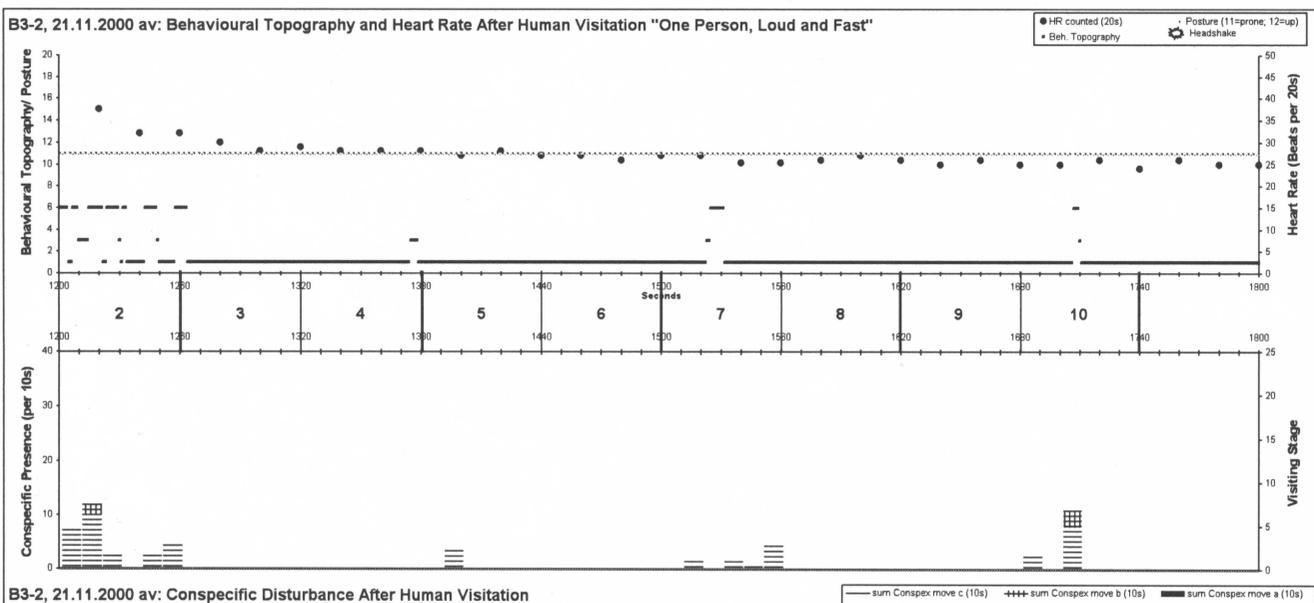
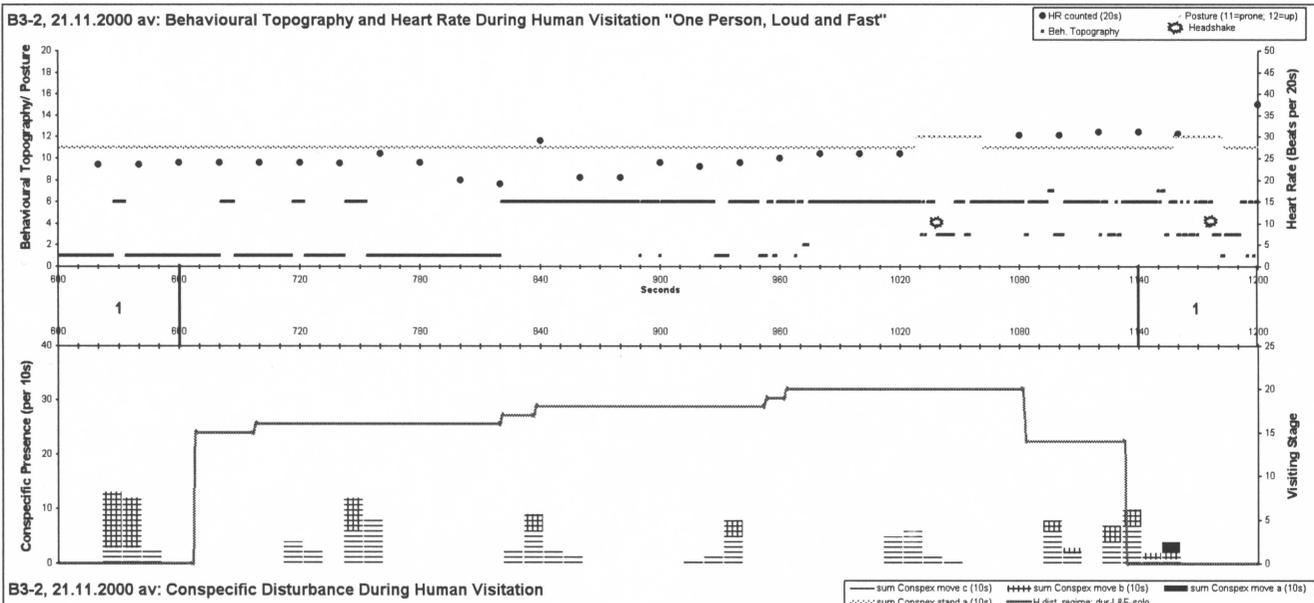
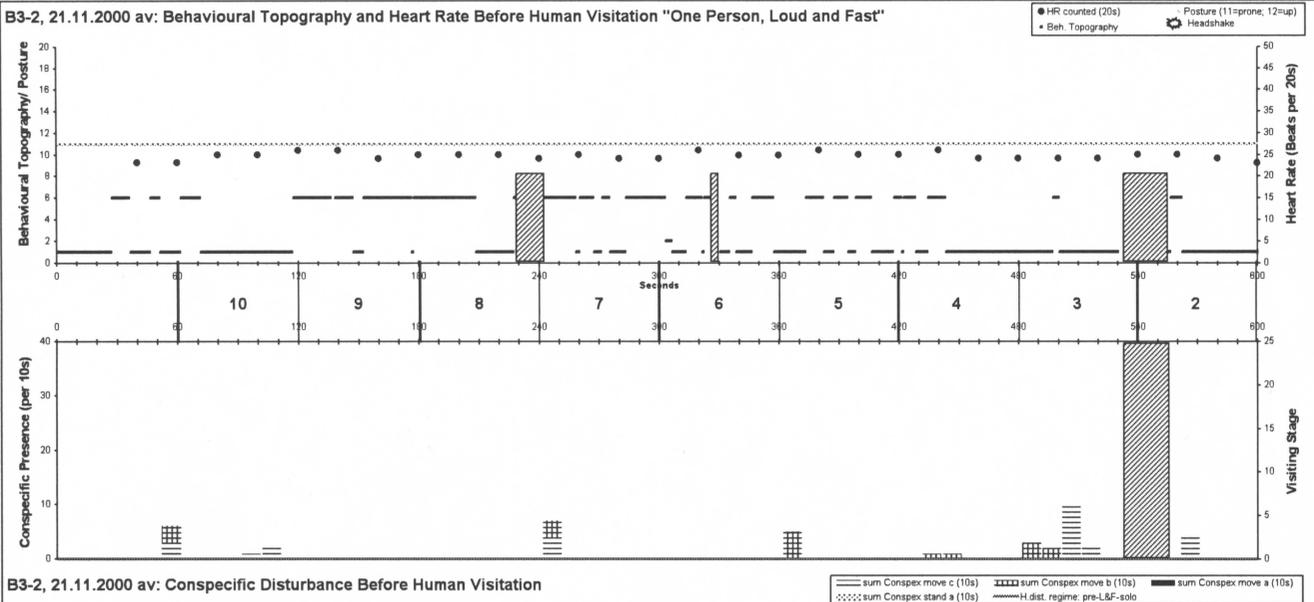


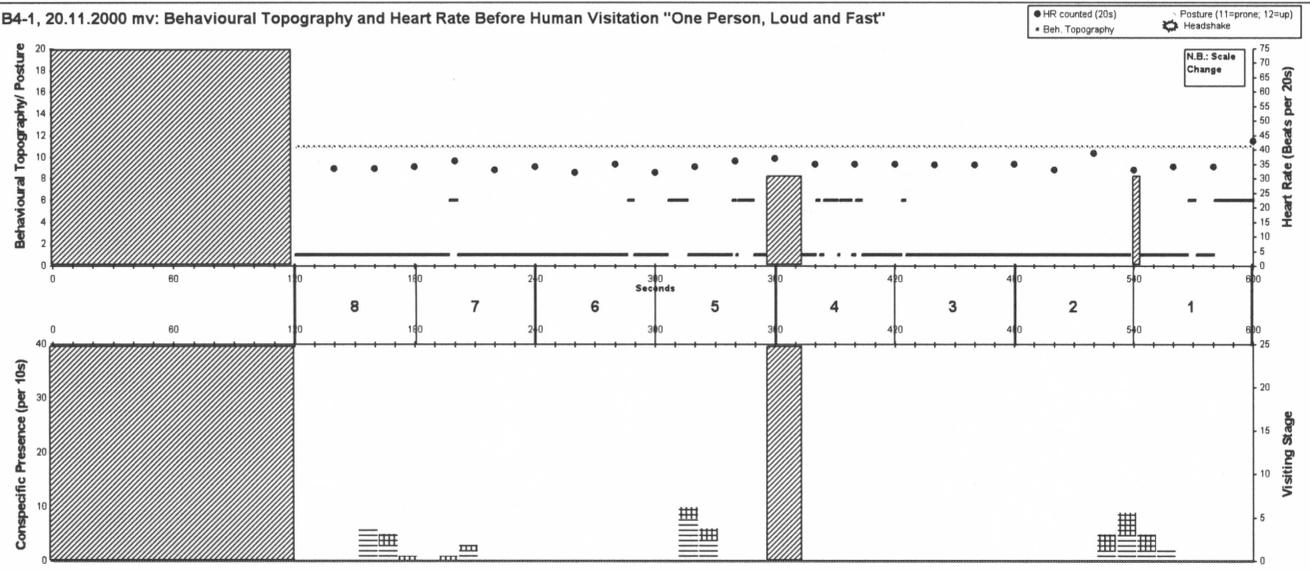
B3-2, 20.11.2000 mv: Behavioural Topography and Heart Rate After Human Visitation "One Person, Loud and Fast"



B3-2, 20.11.2000 mv: Conspecific Disturbance After Human Visitation

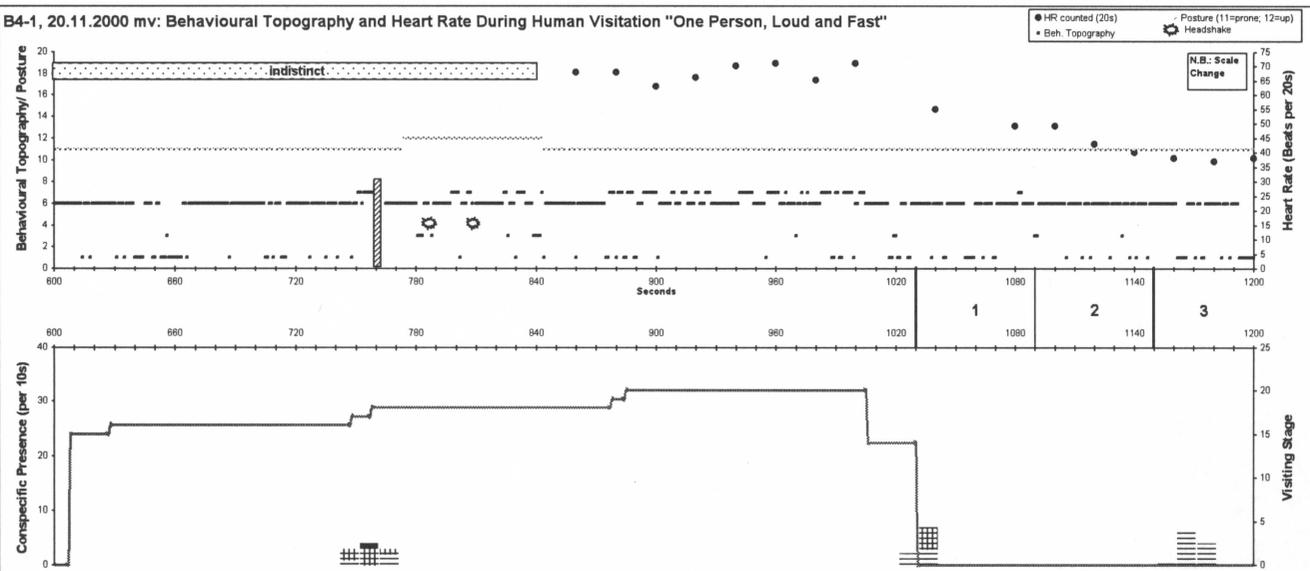






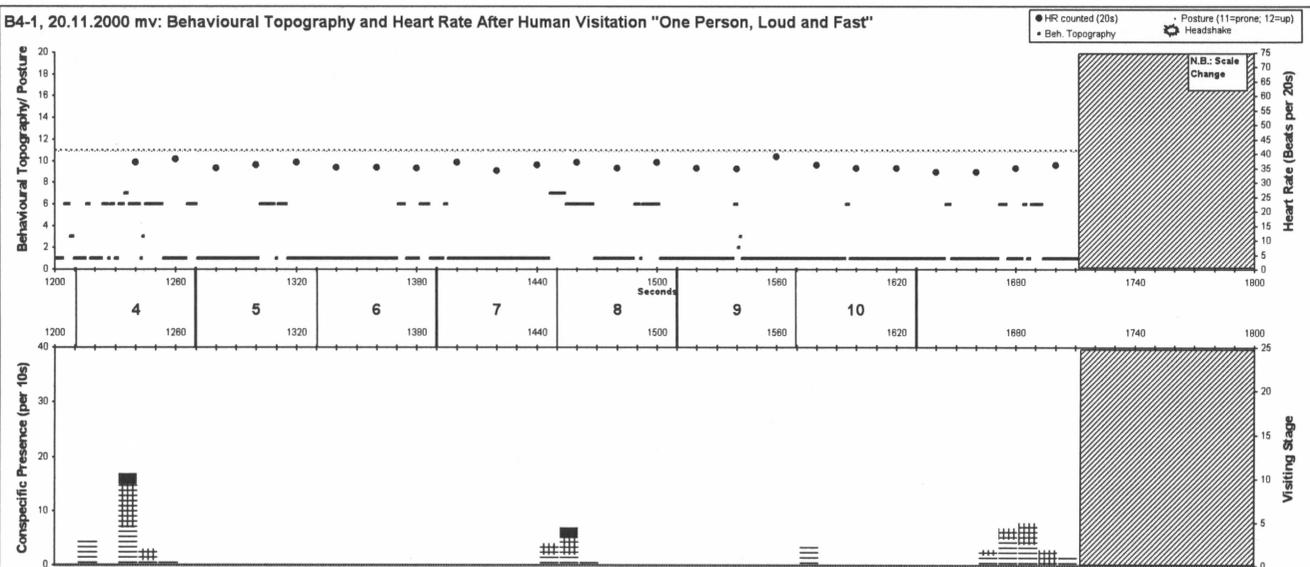
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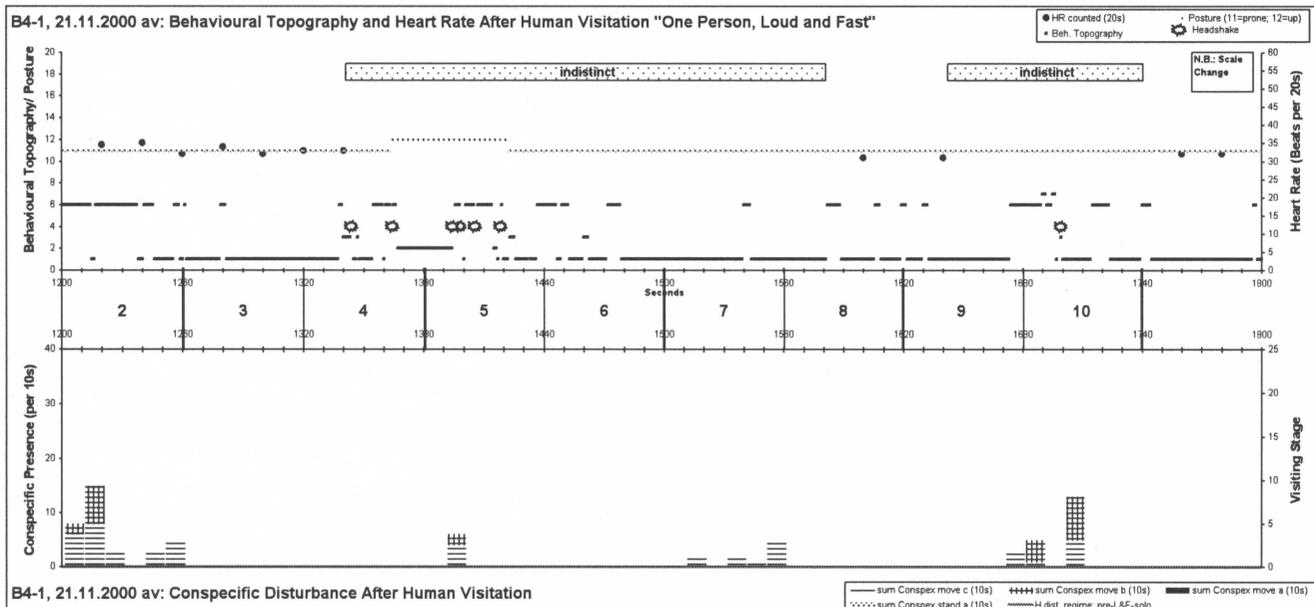
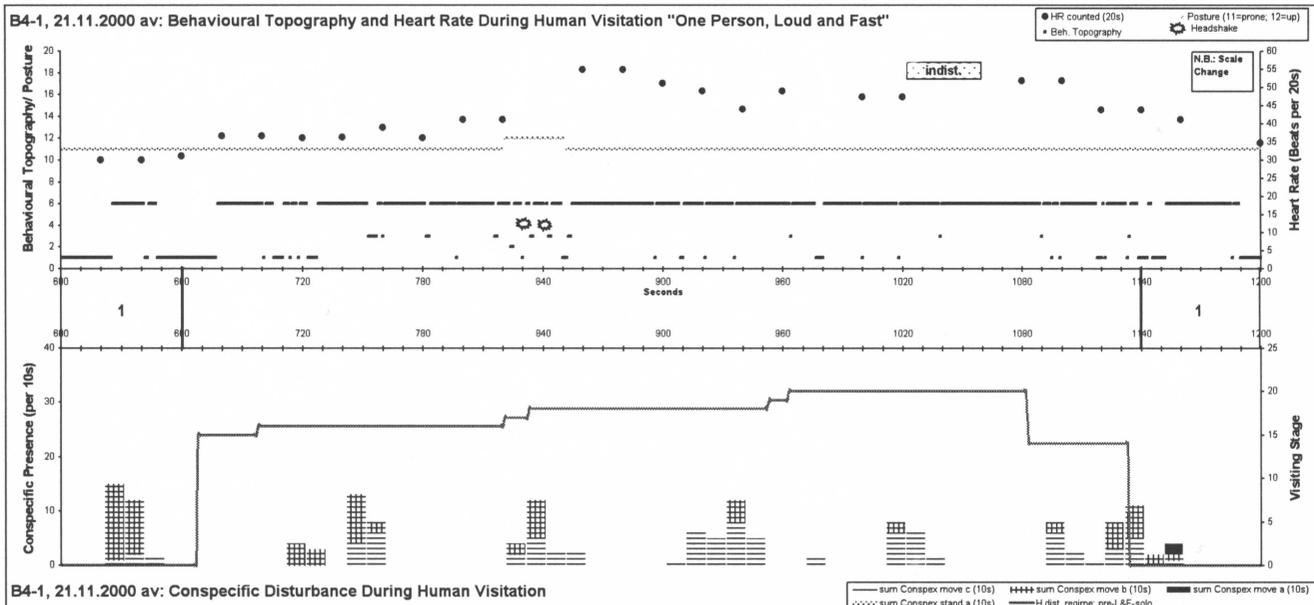
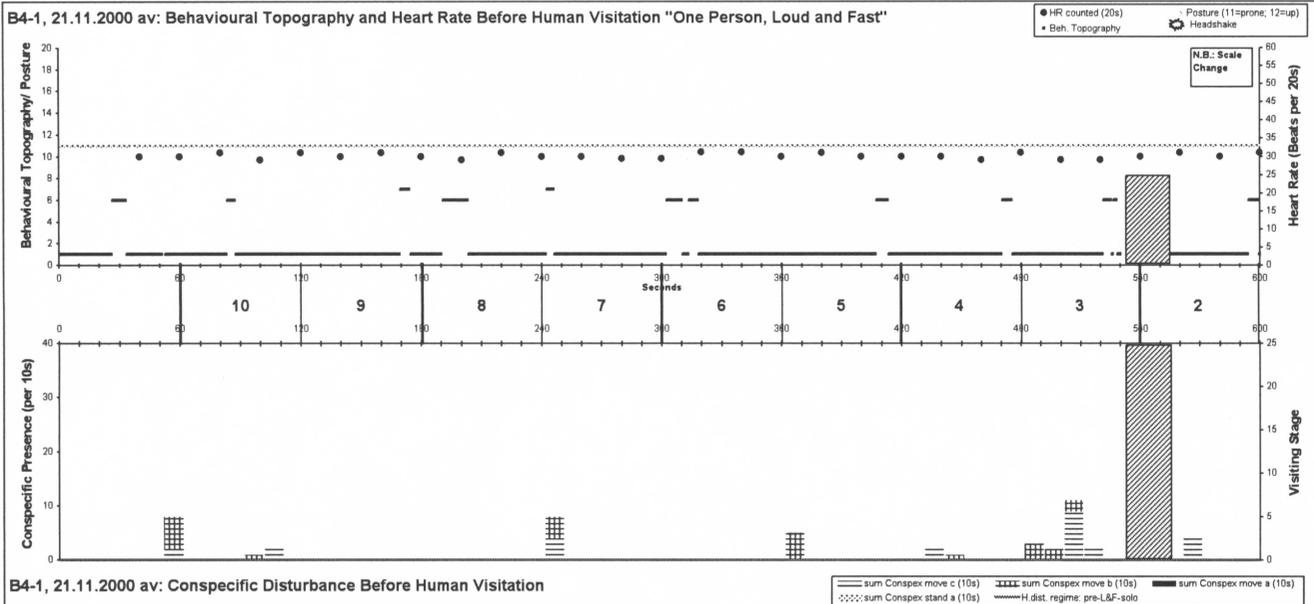
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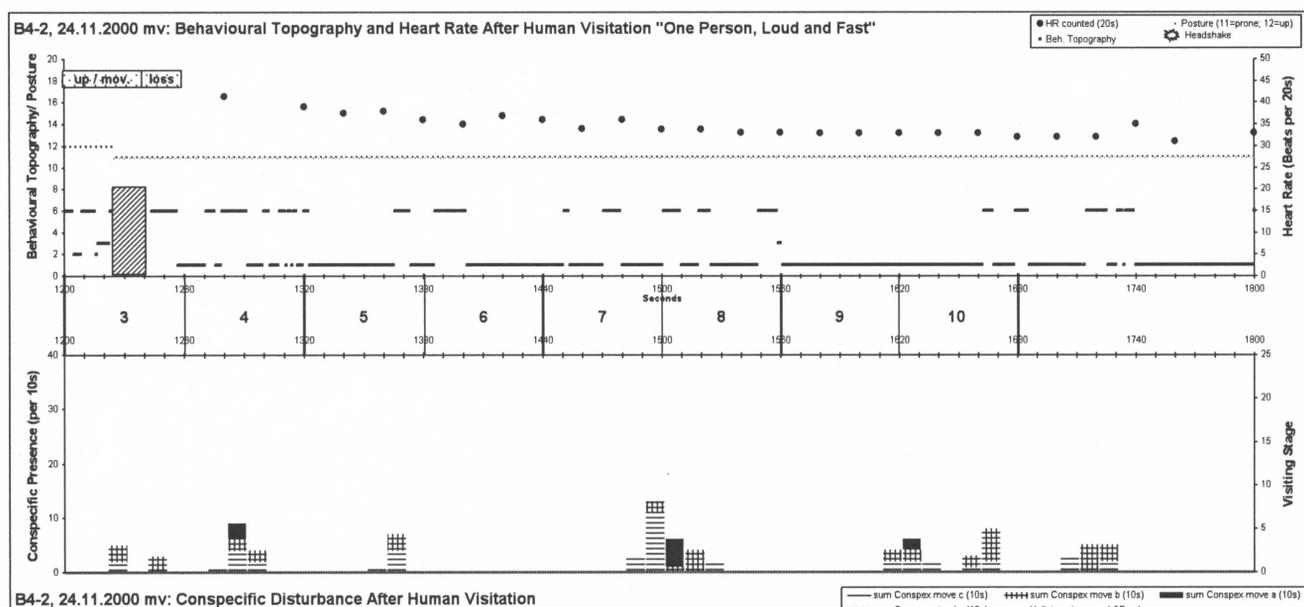
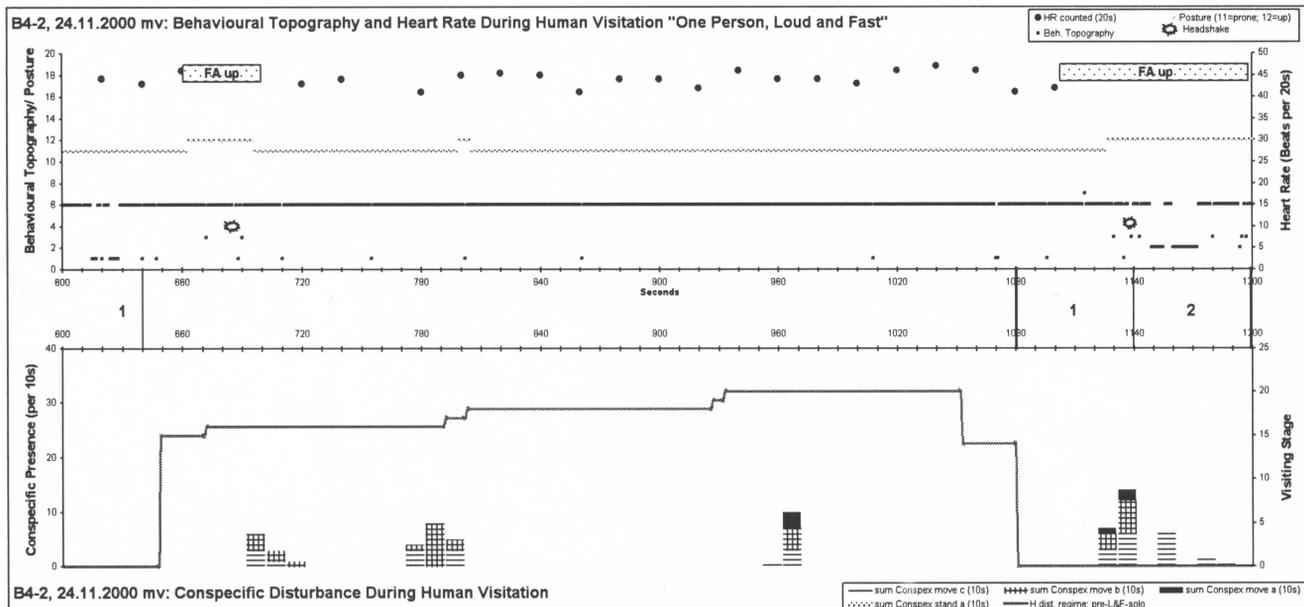
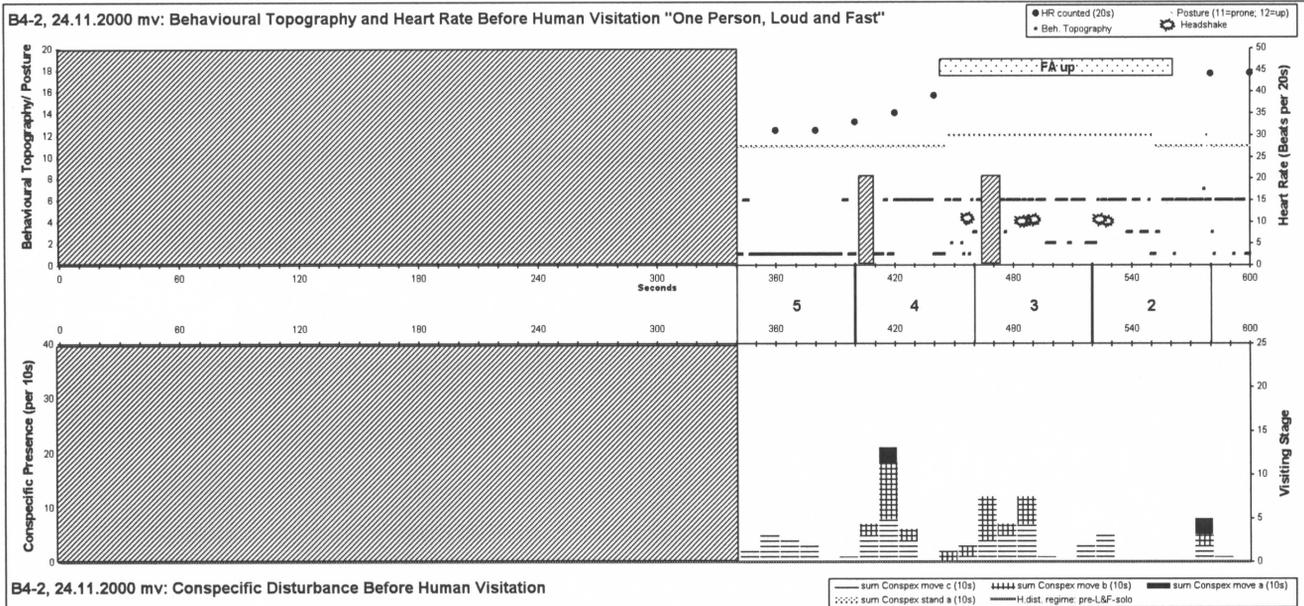
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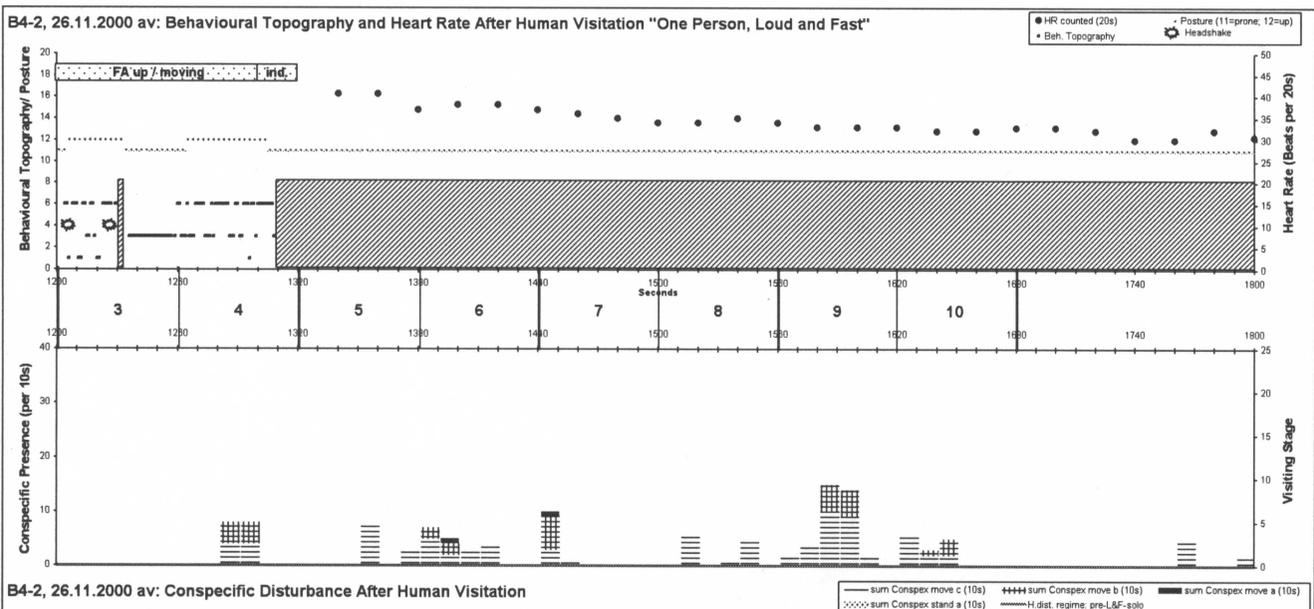
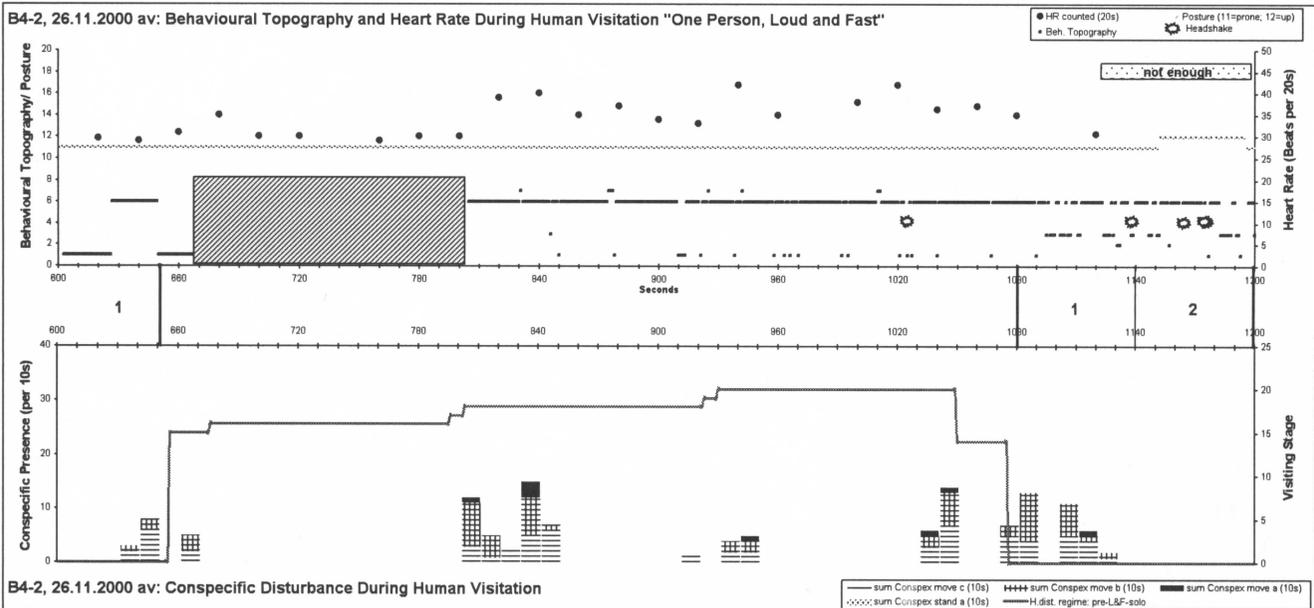
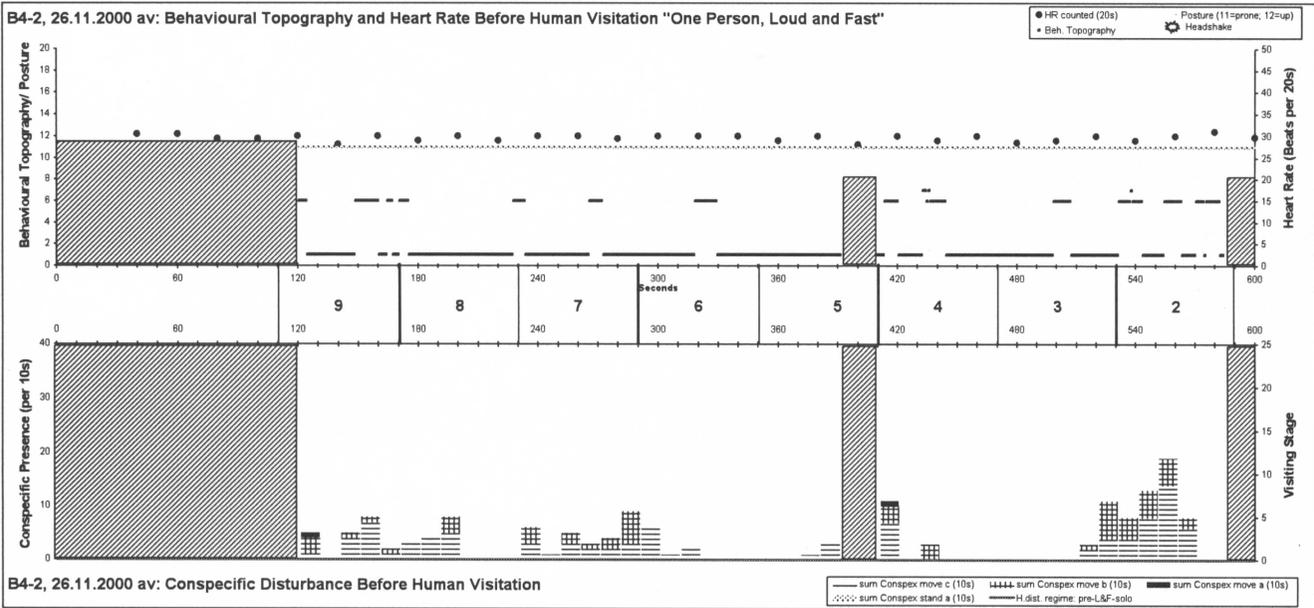
**B4-1, 20.11.2000 mv: Conspecific Disturbance After Human Visitation**

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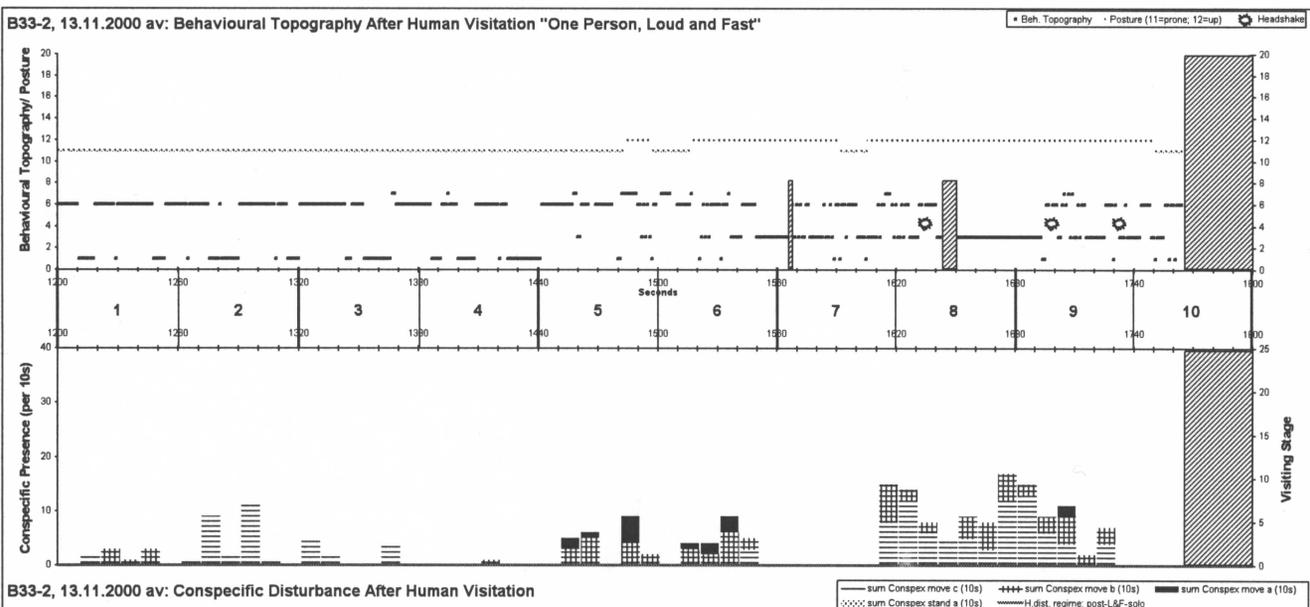
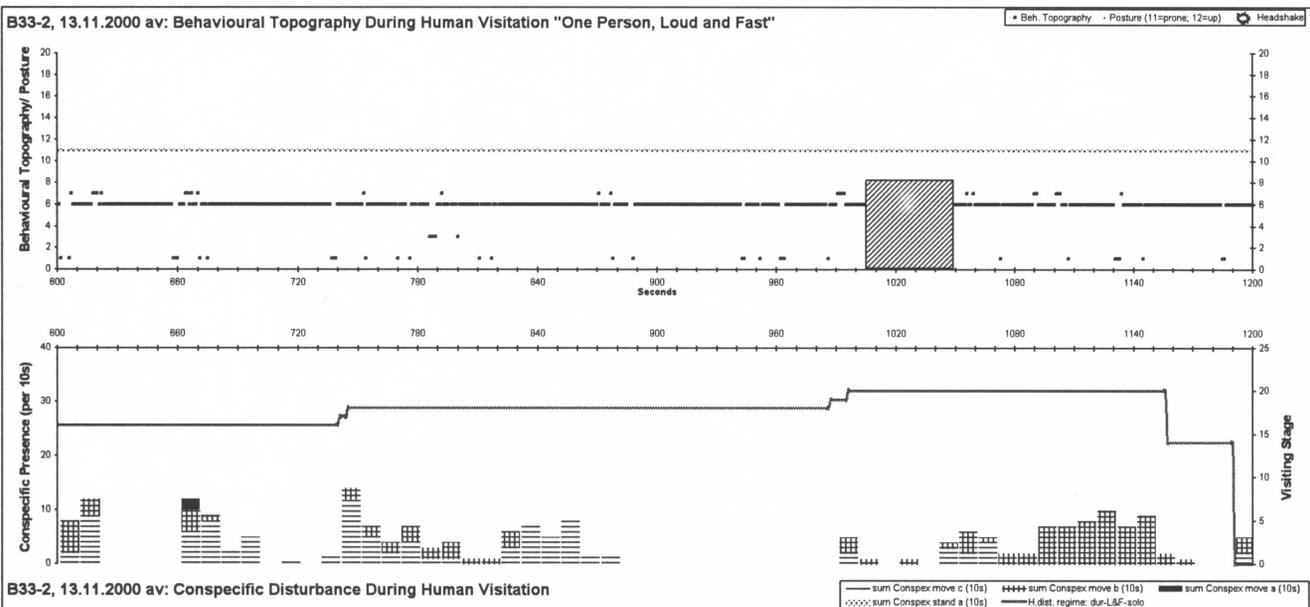
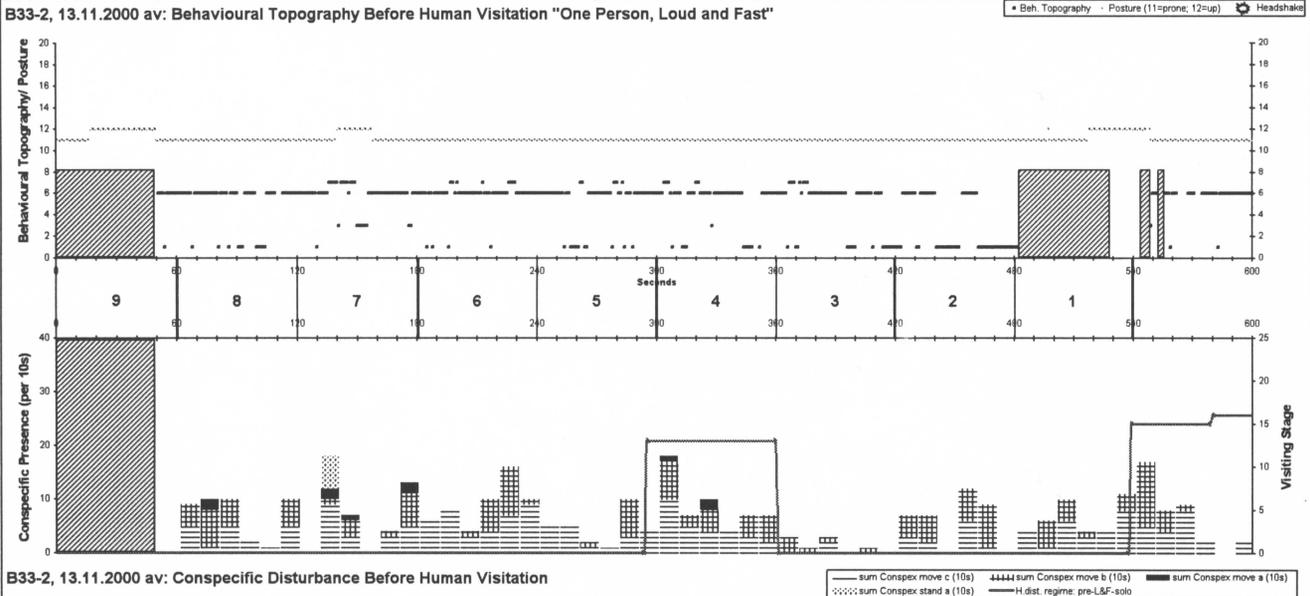


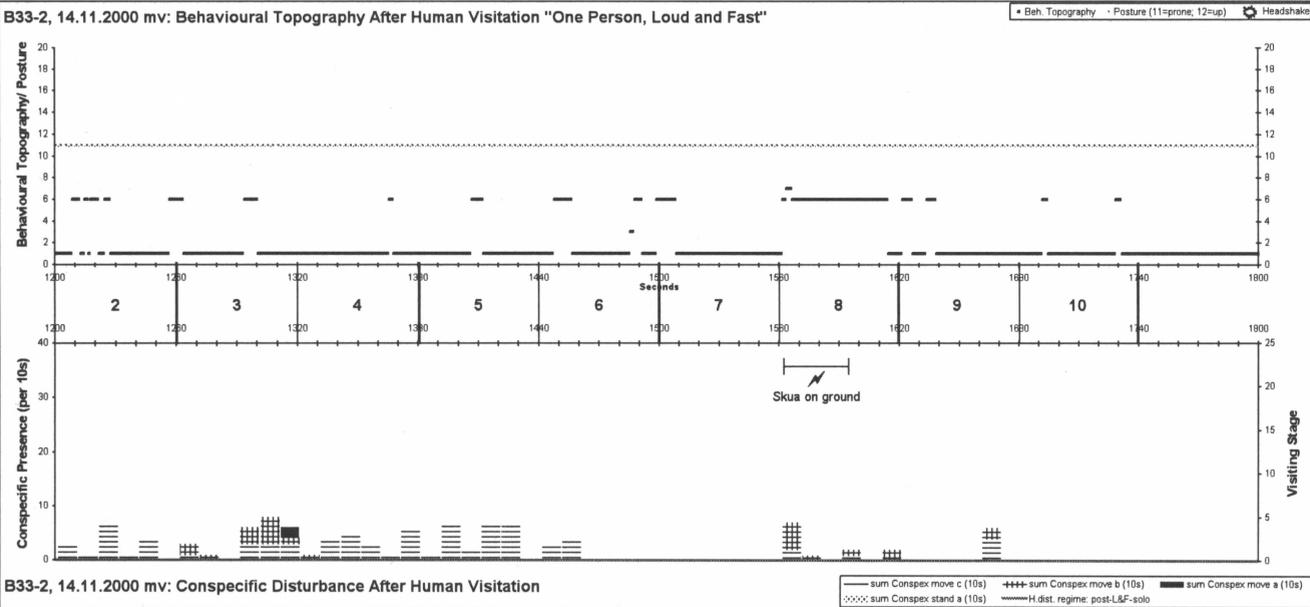
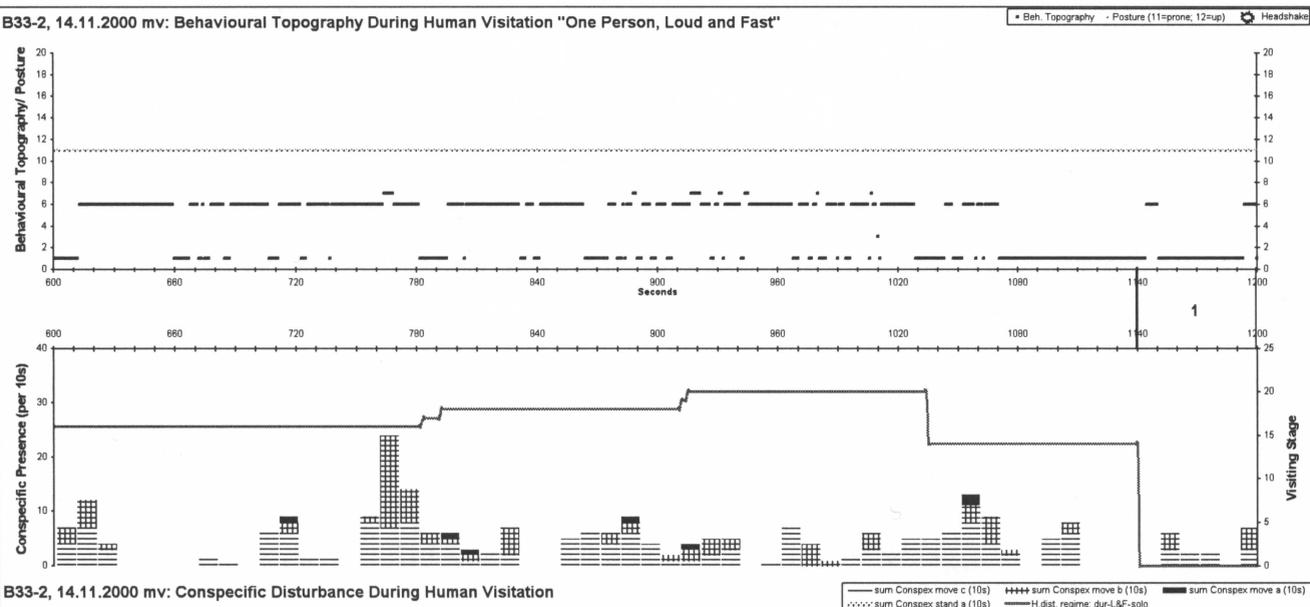
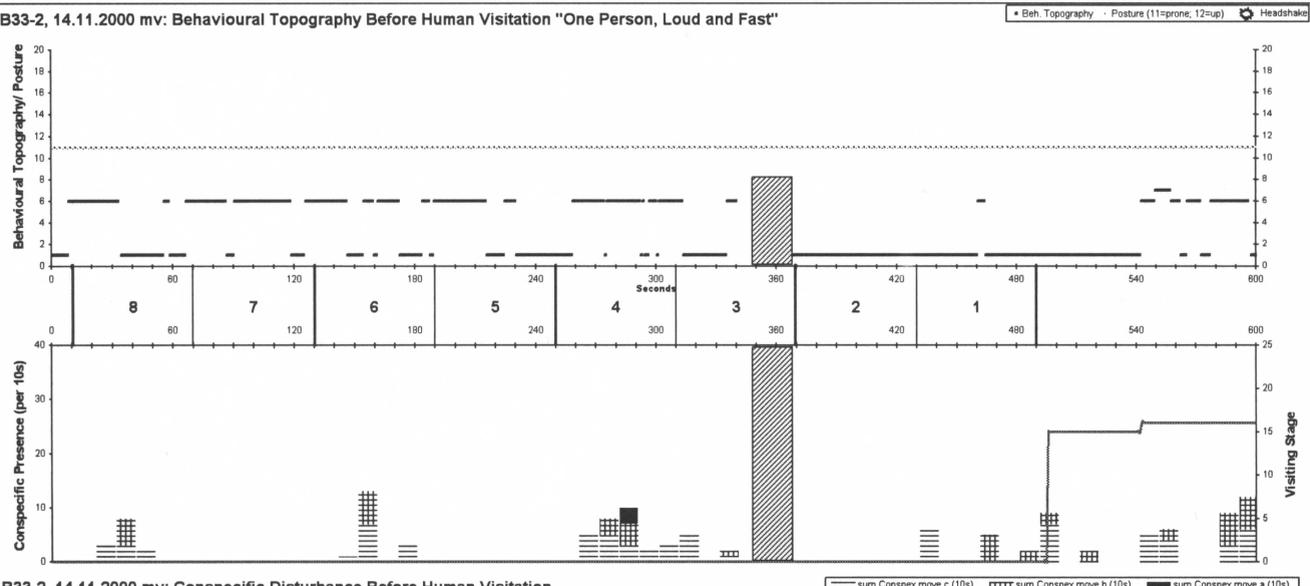


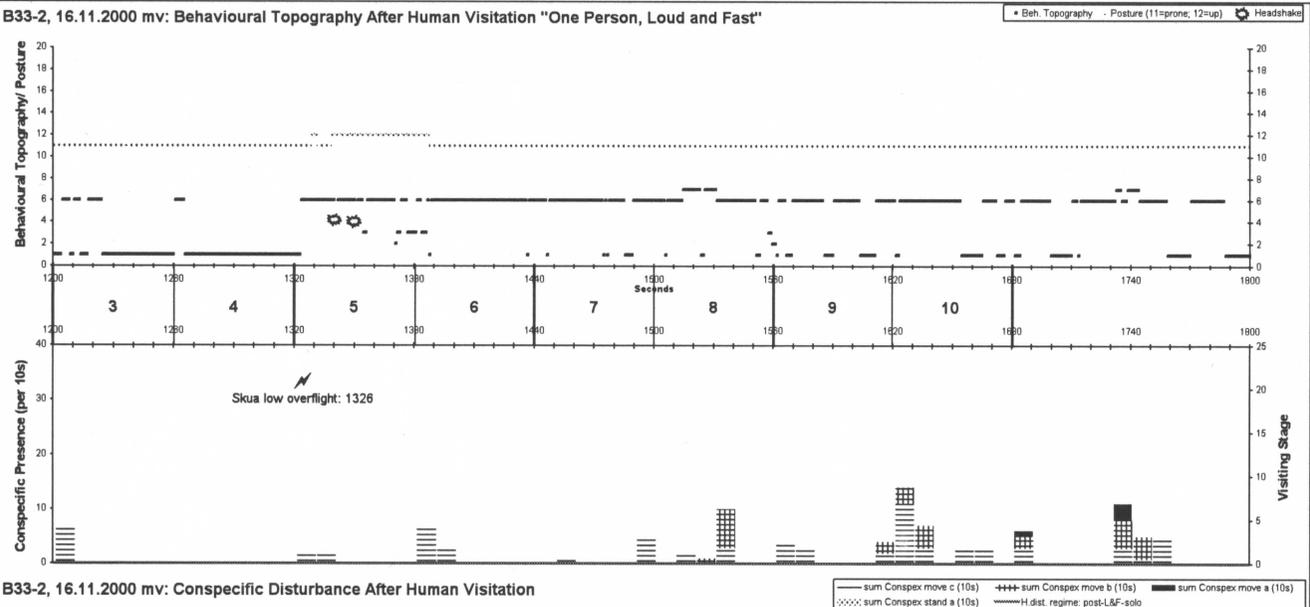
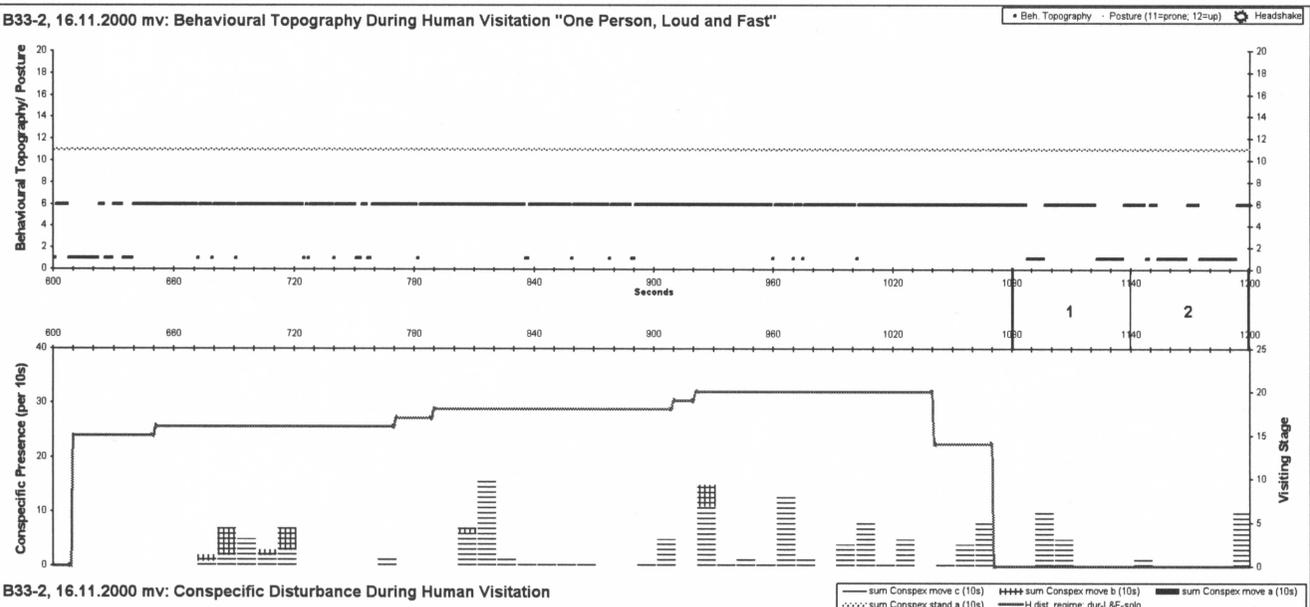
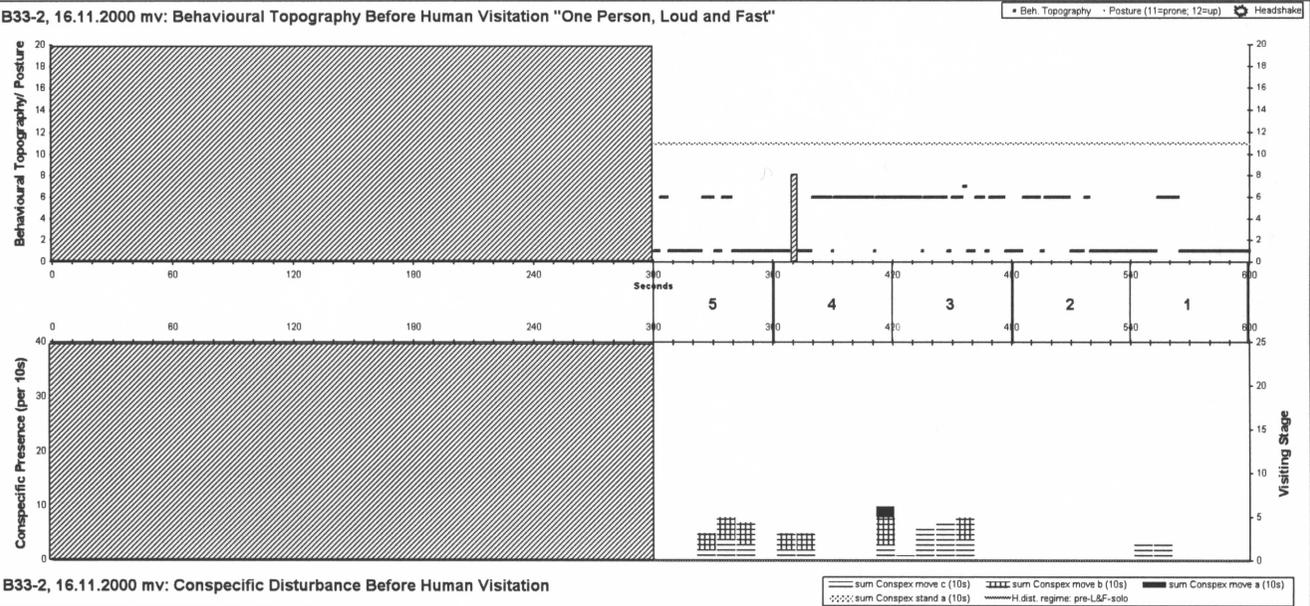
# Behavioural Topography, Heart Rate and Conspecific Disturbance before, during and after Human Visitation

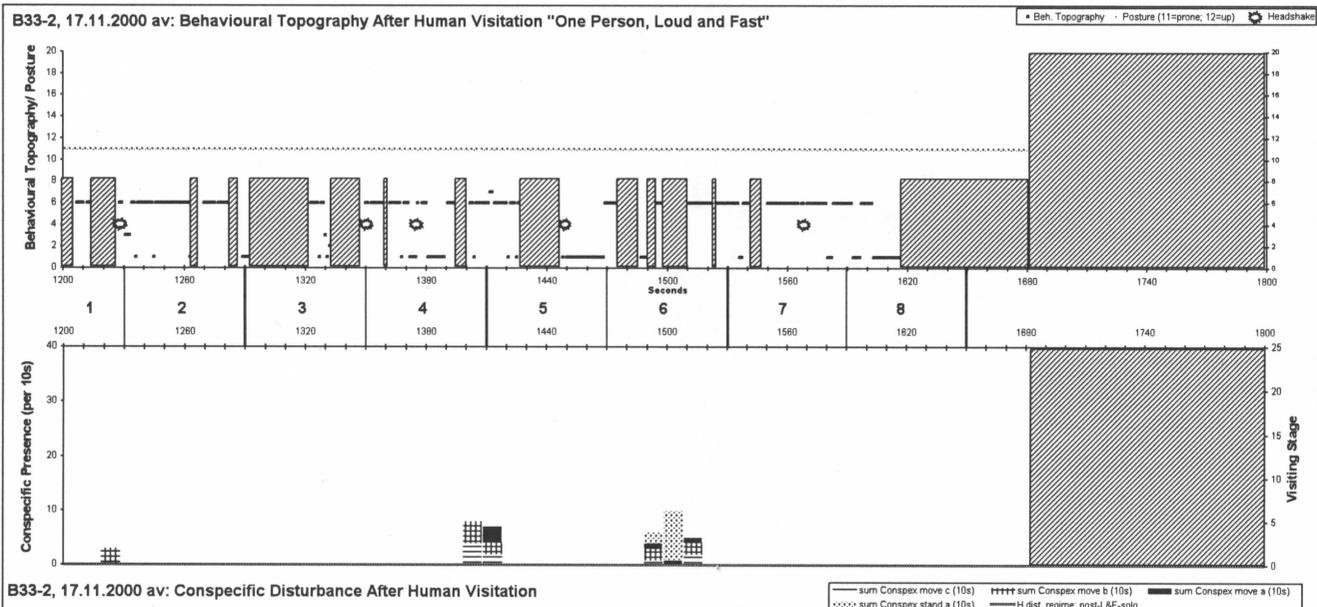
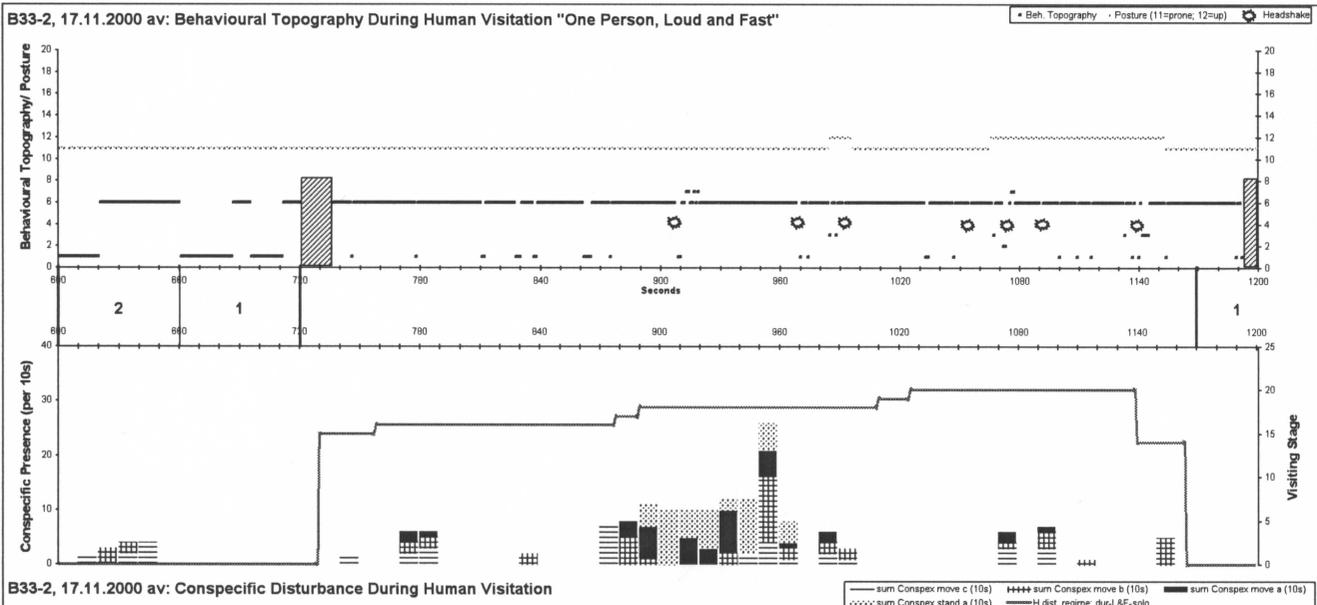
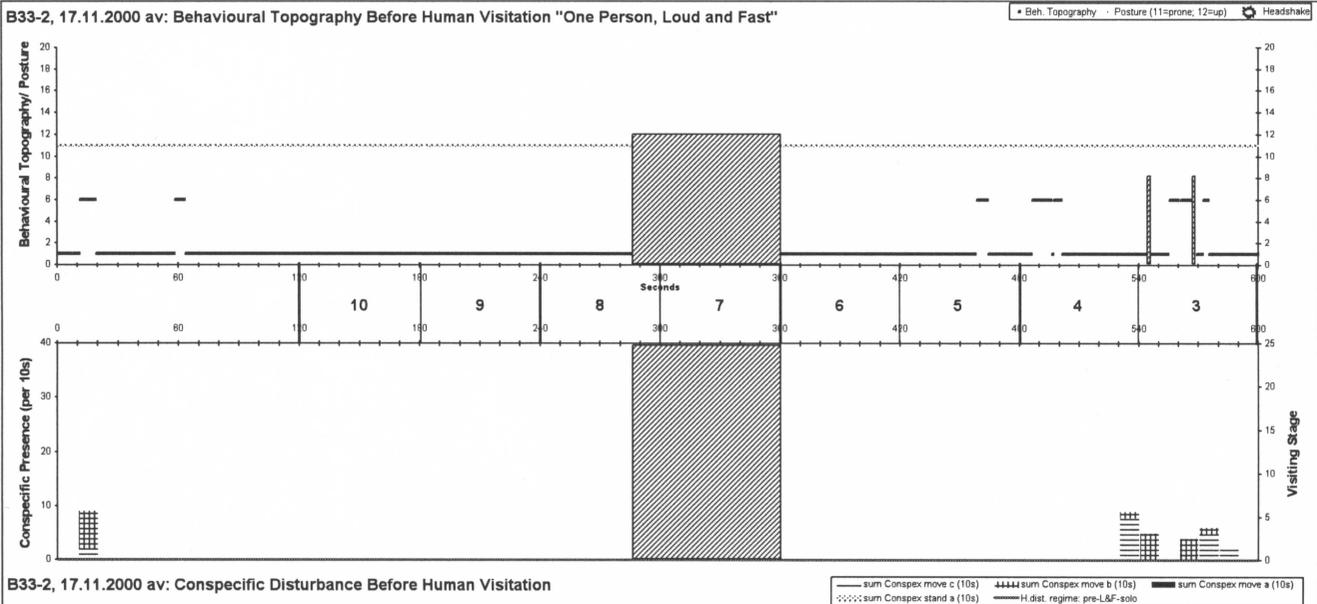


# Behavioural Topography and Conspecific Disturbance before, during and after Human Visitation

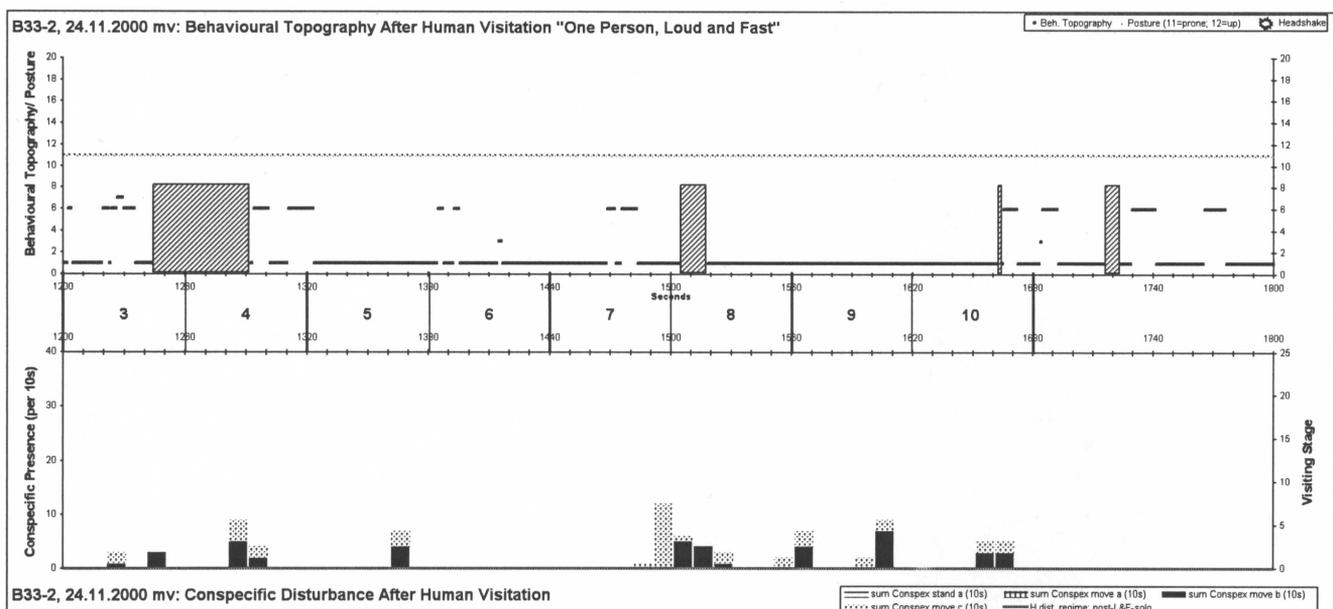
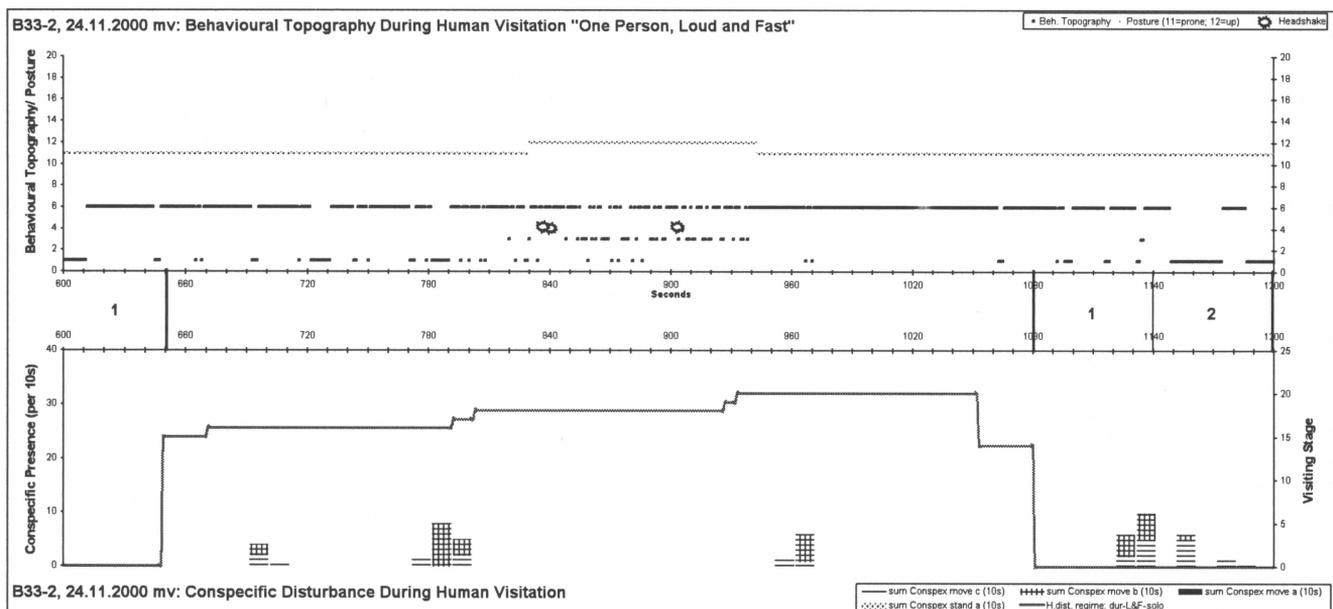
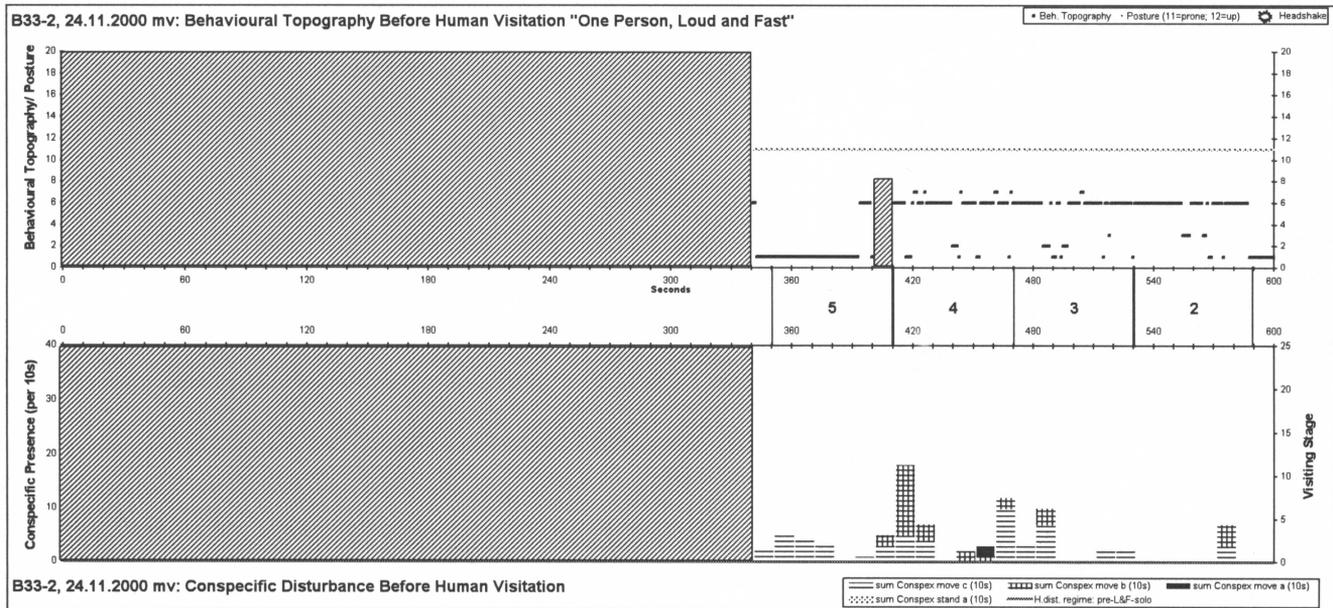


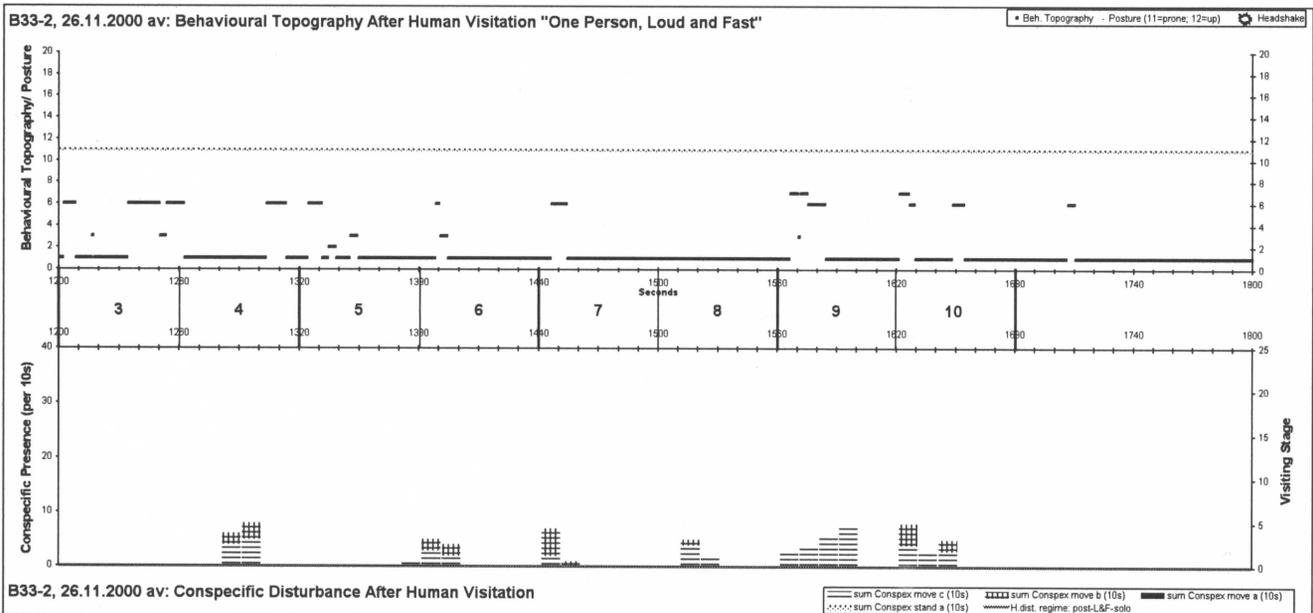
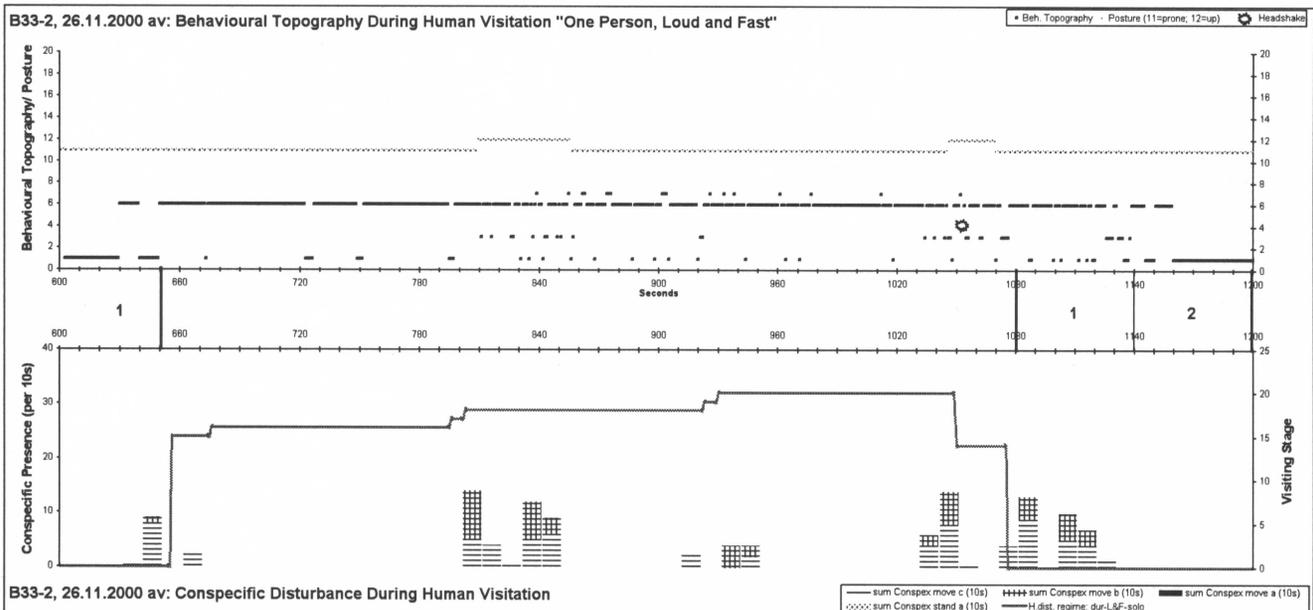
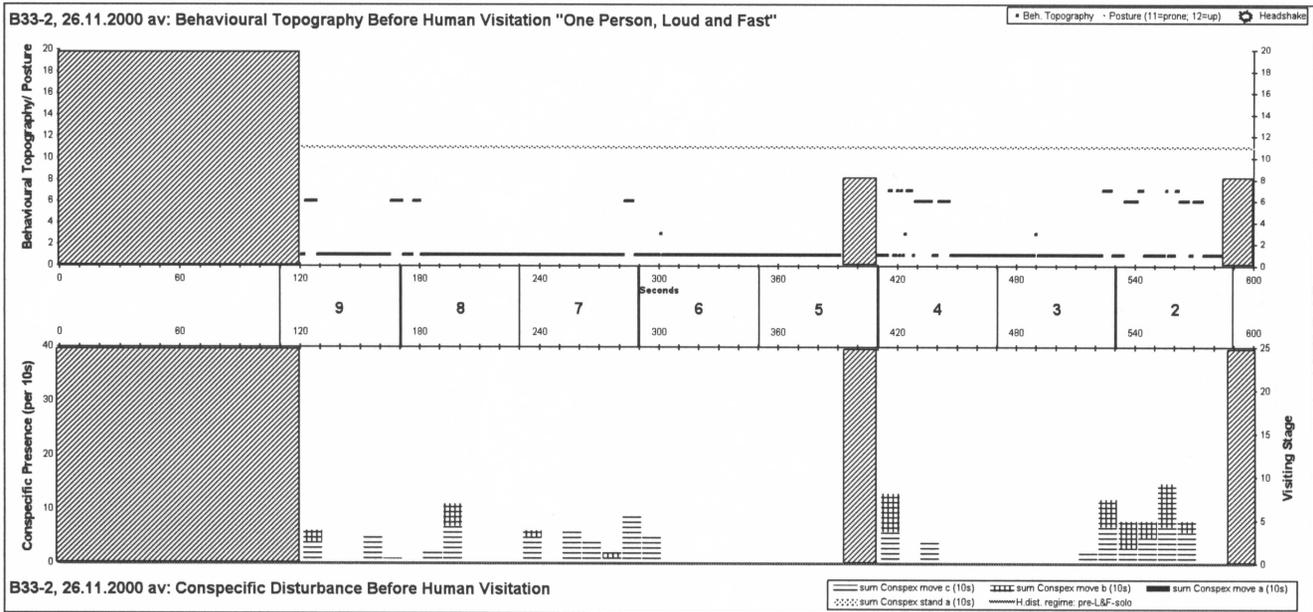




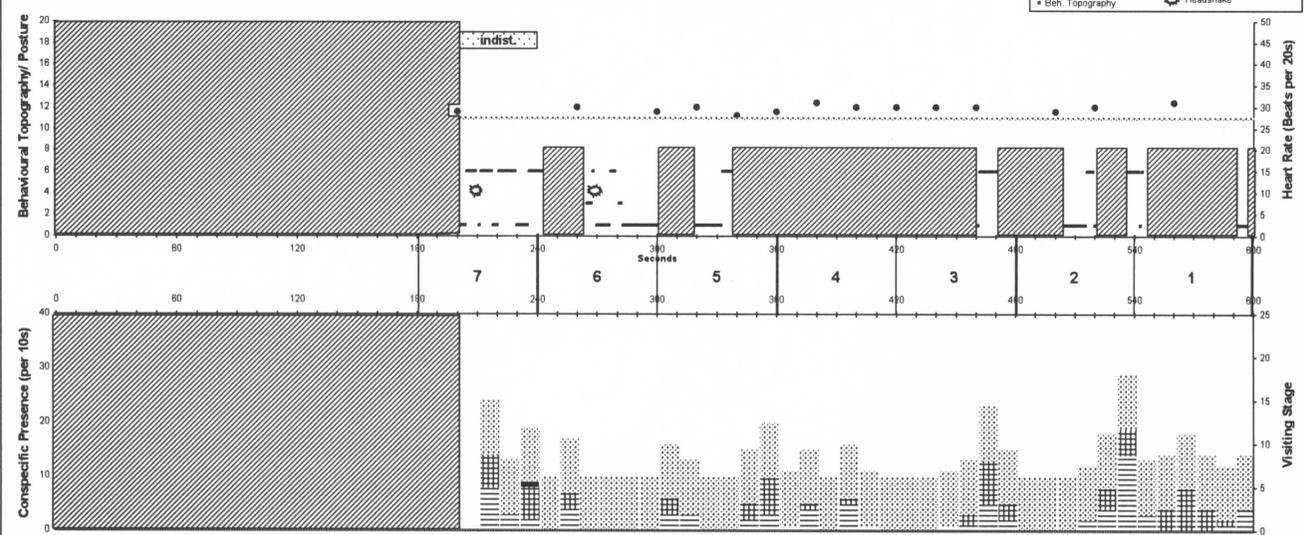


# Behavioural Topography and Conspecific Disturbance before, during and after Human Visitation





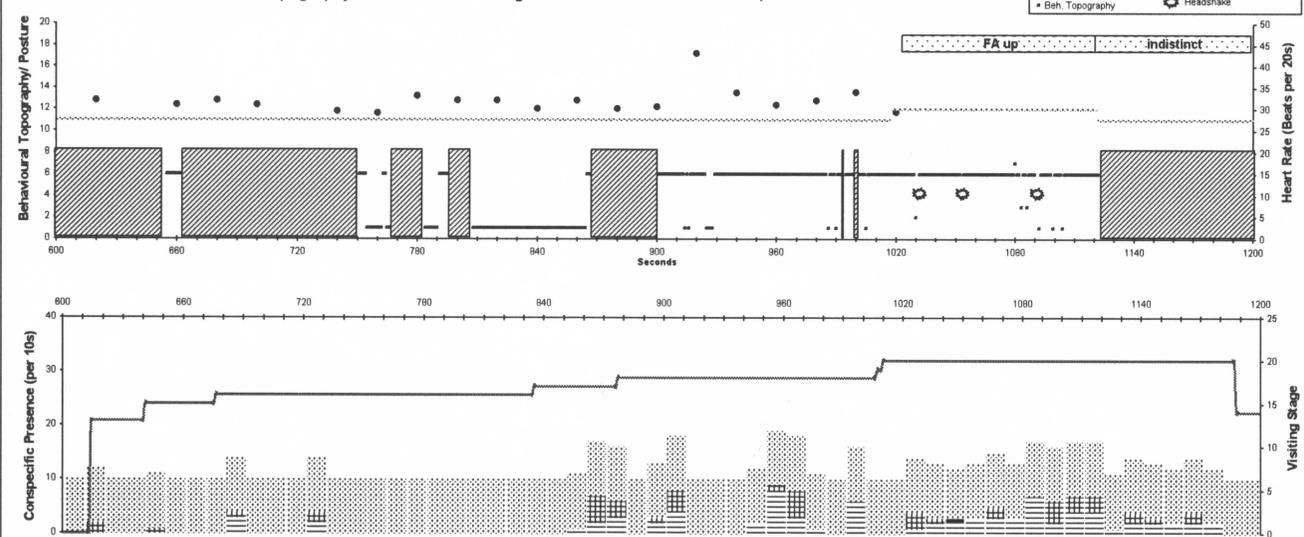
C1-1, 13.11.2000 av: Behavioural Topography and Heart Rate Before Human Visitation "One Person, Silent and Slow"



C1-1, 13.11.2000 av: Conspecific Disturbance Before Human Visitation



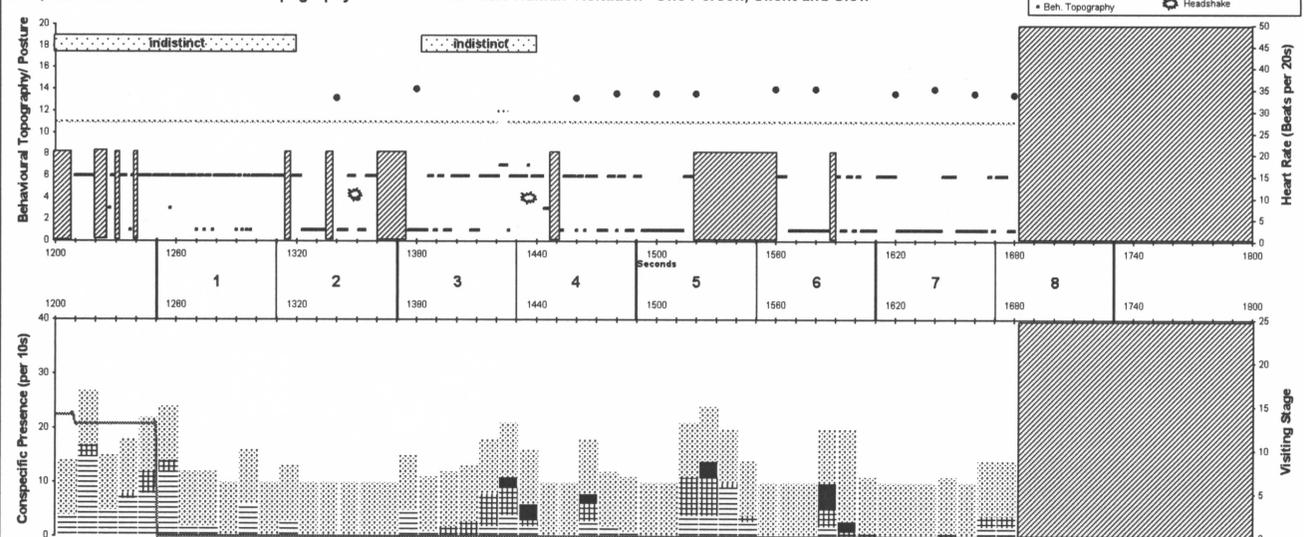
C1-1, 13.11.2000 av: Behavioural Topography and Heart Rate During Human Visitation "One Person, Silent and Slow"



C1-1, 13.11.2000 av: Conspecific Disturbance During Human Visitation



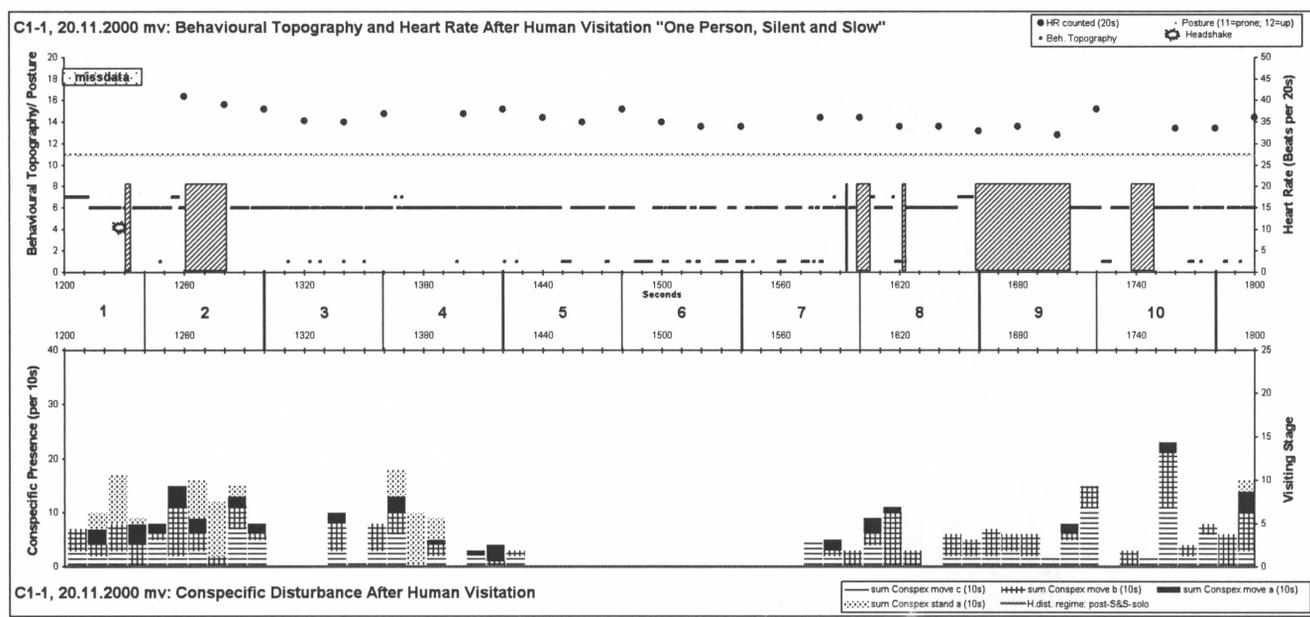
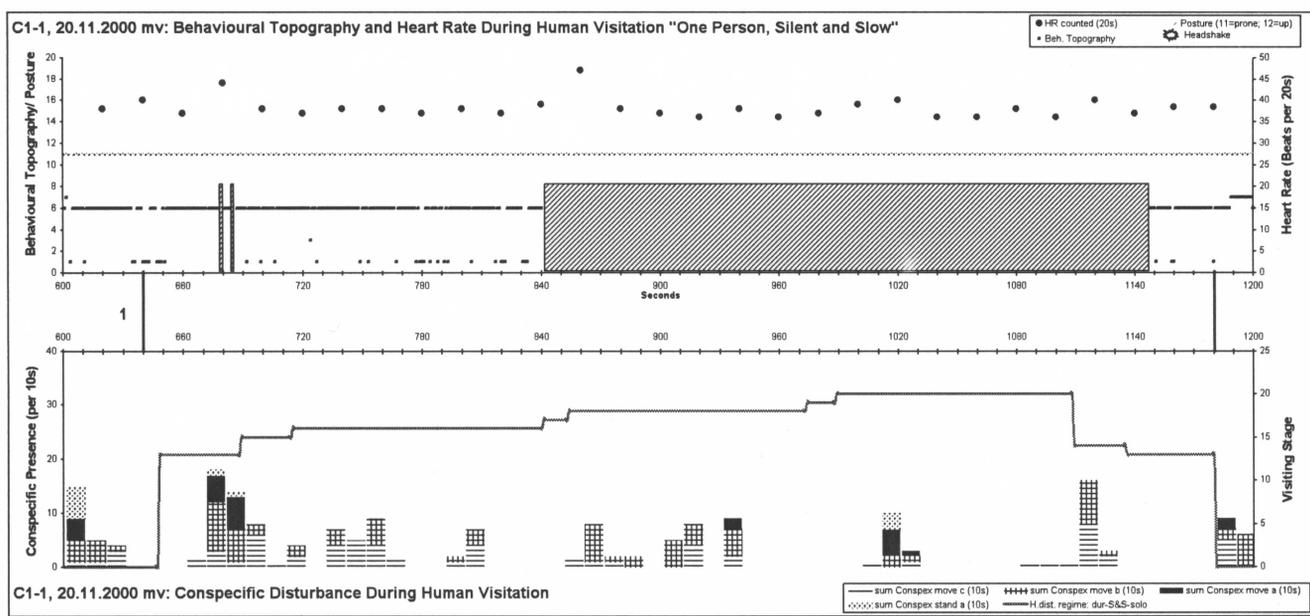
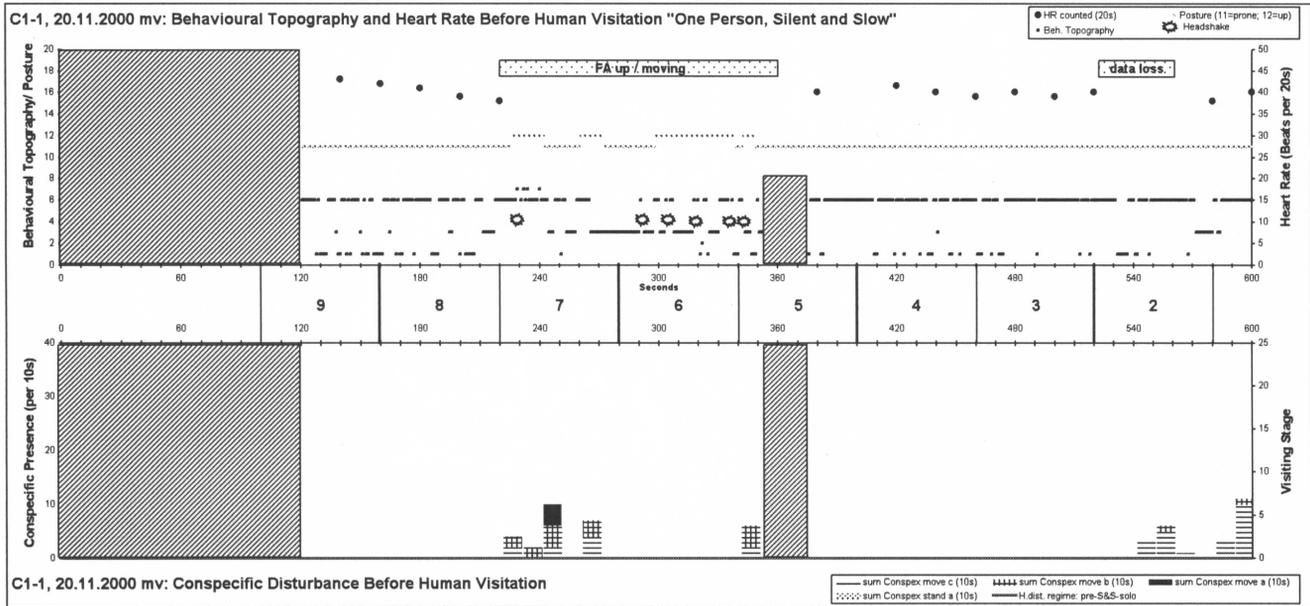
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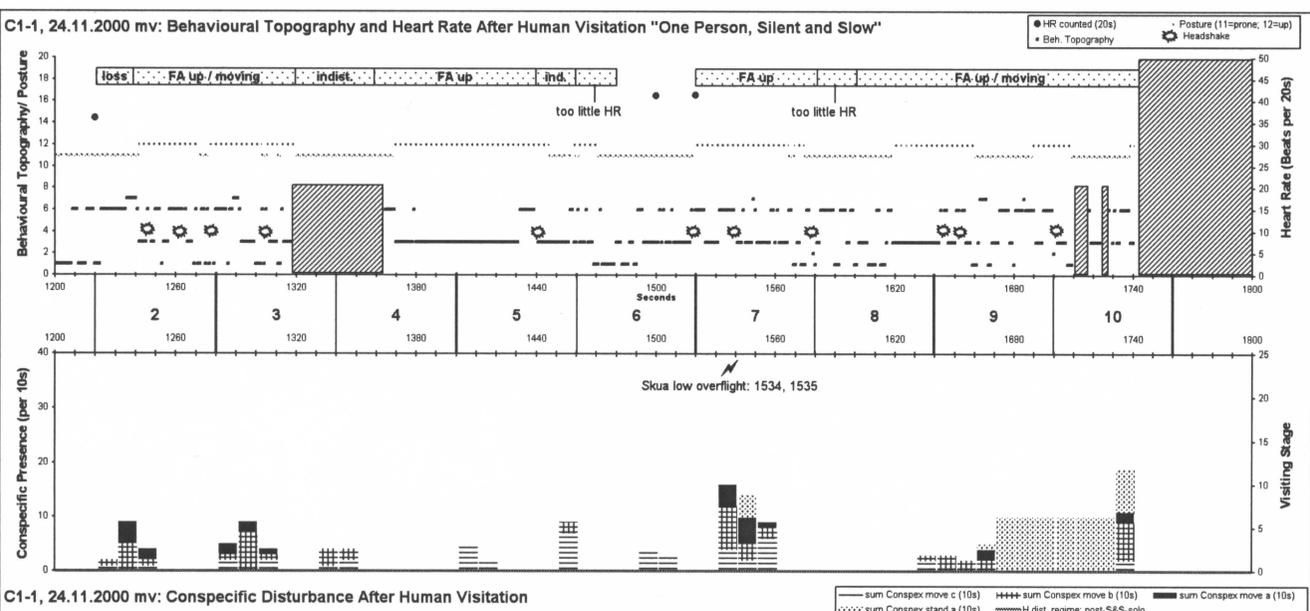
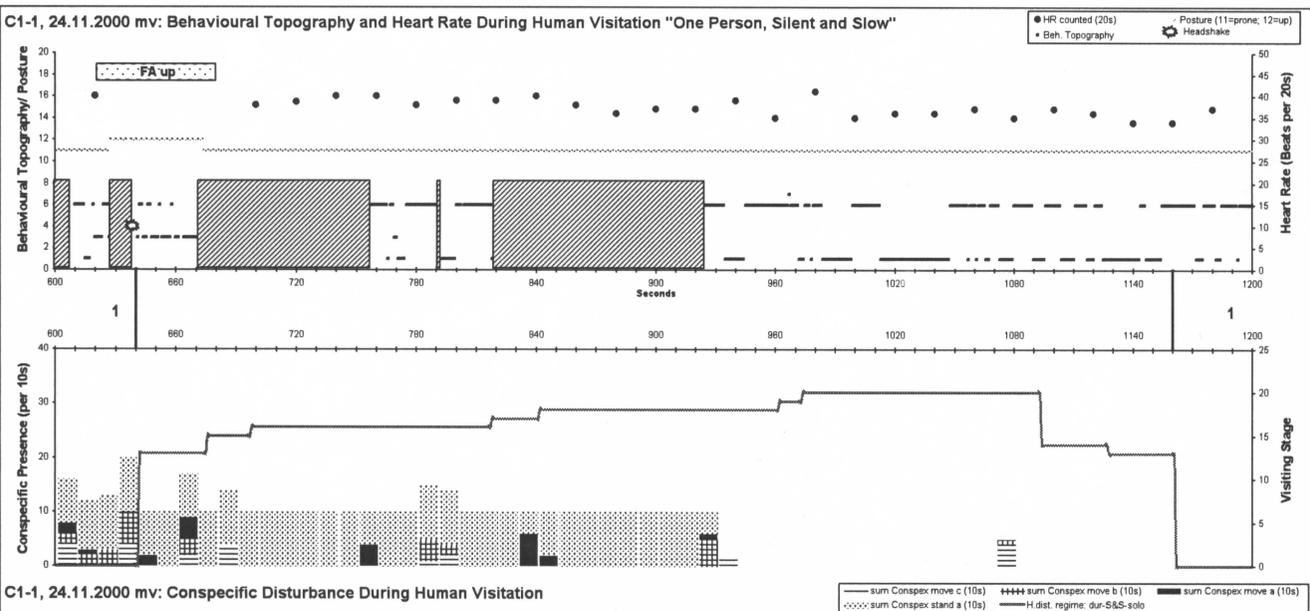
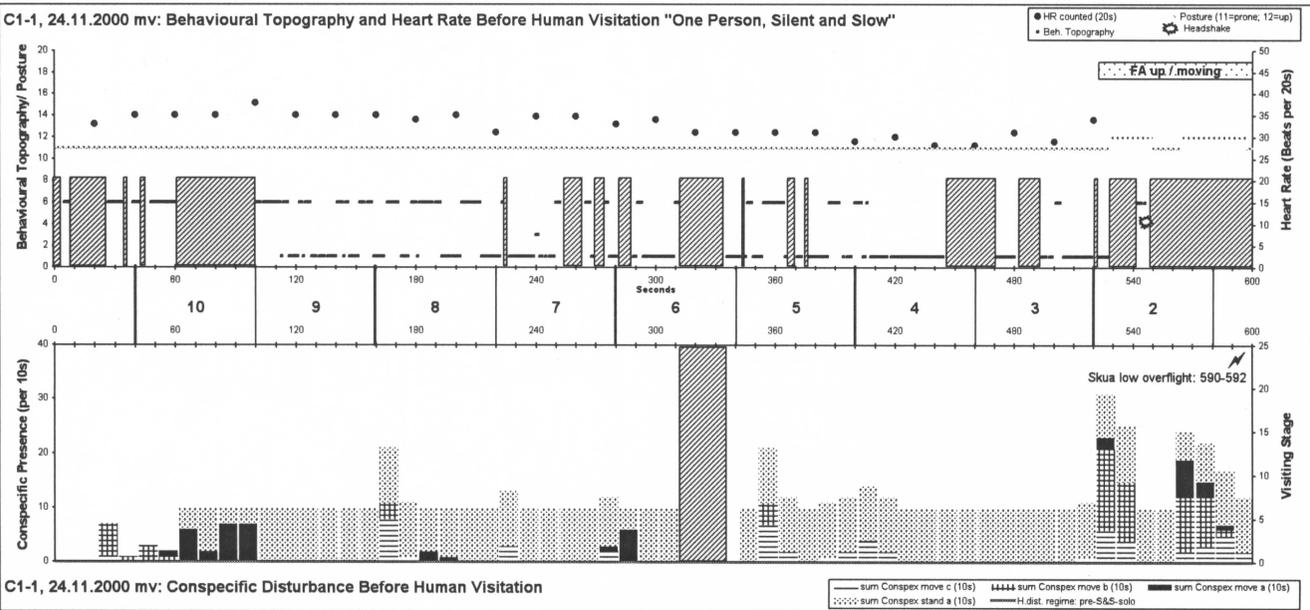


C1-1, 13.11.2000 av: Conspecific Disturbance After Human Visitation

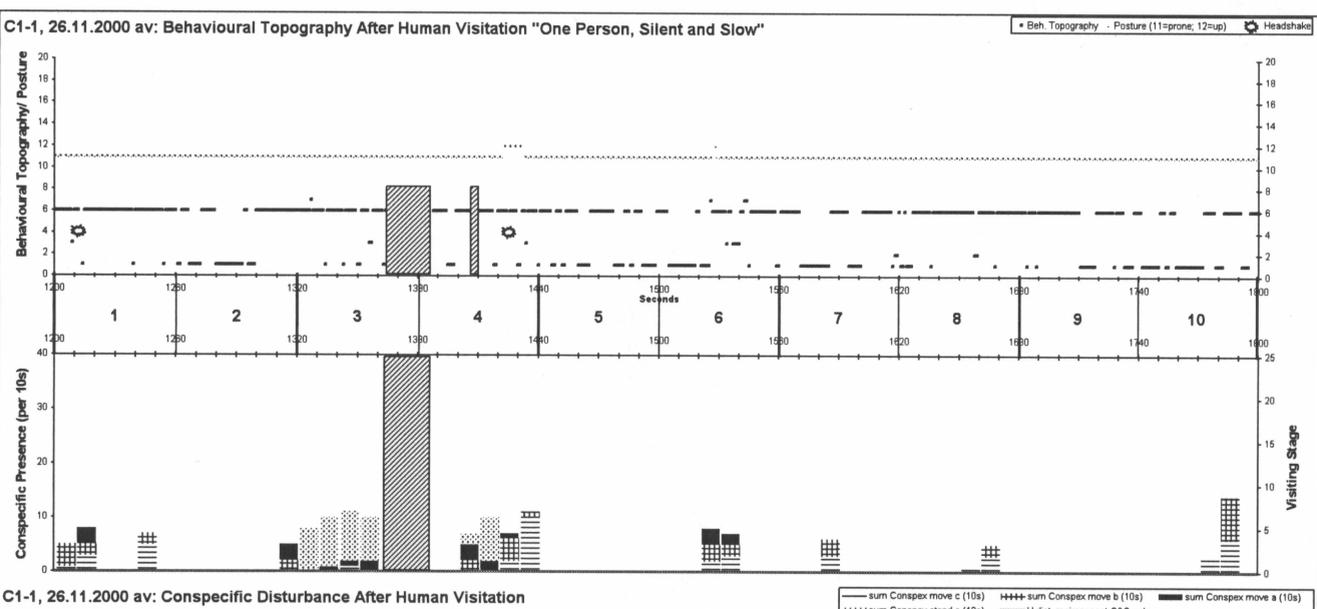
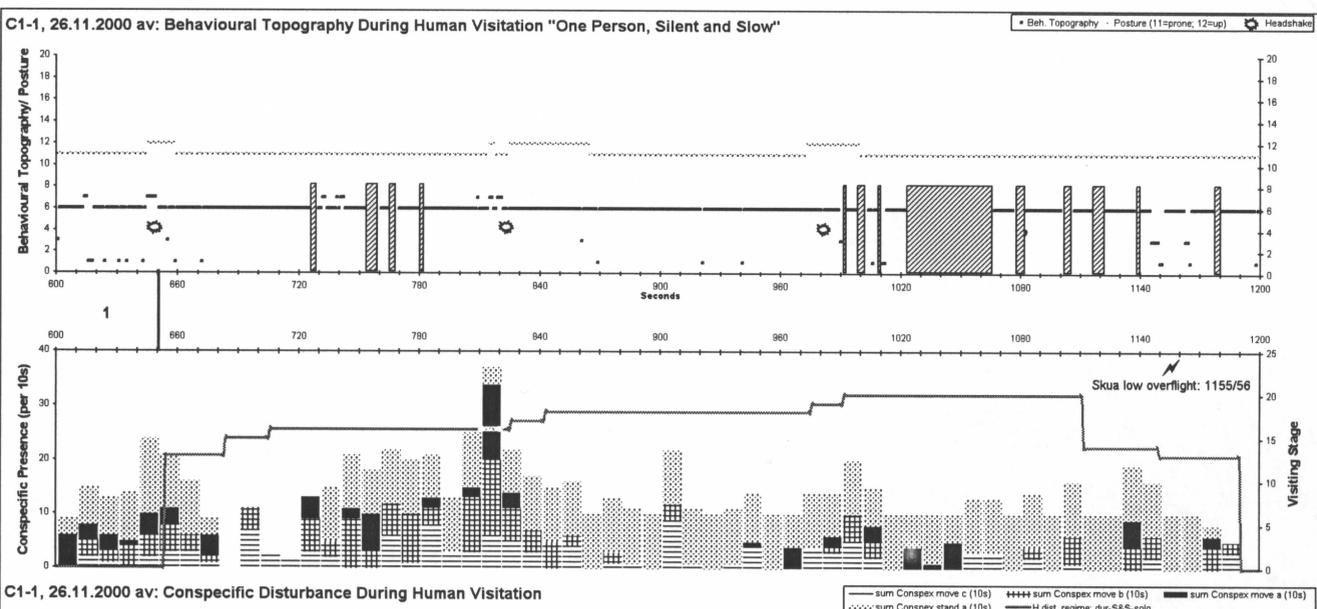
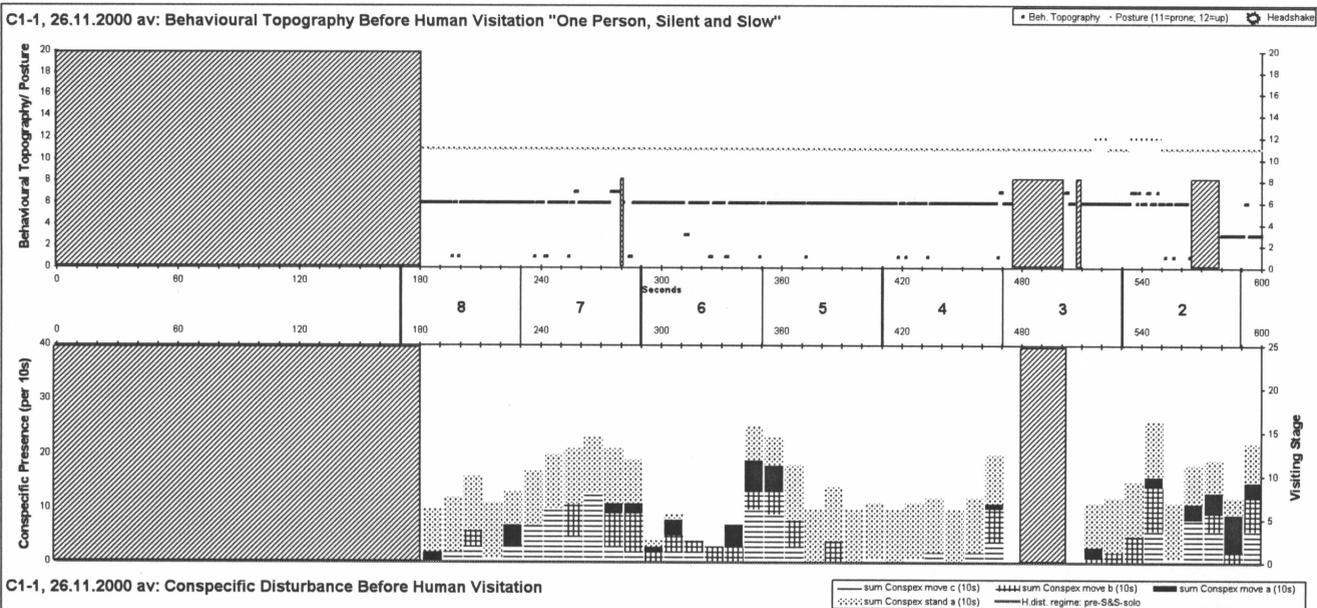


# Behavioural Topography, Heart Rate and Conspecific Disturbance before, during and after Human Visitation

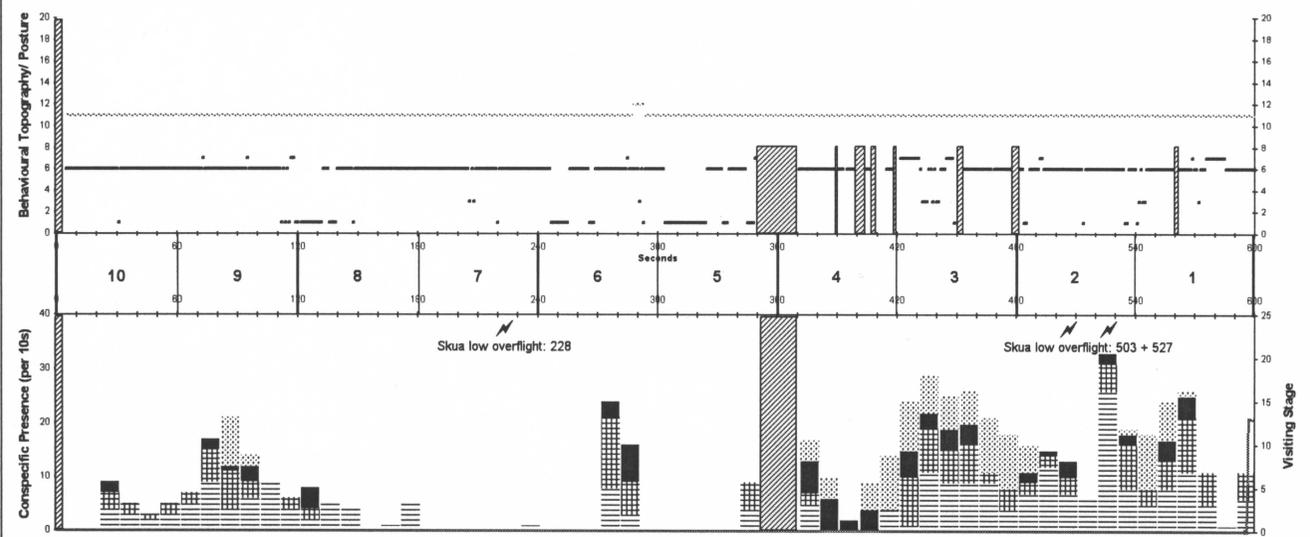




# Behavioural Topography and Conspecific Disturbance before, during and after Human Visitation



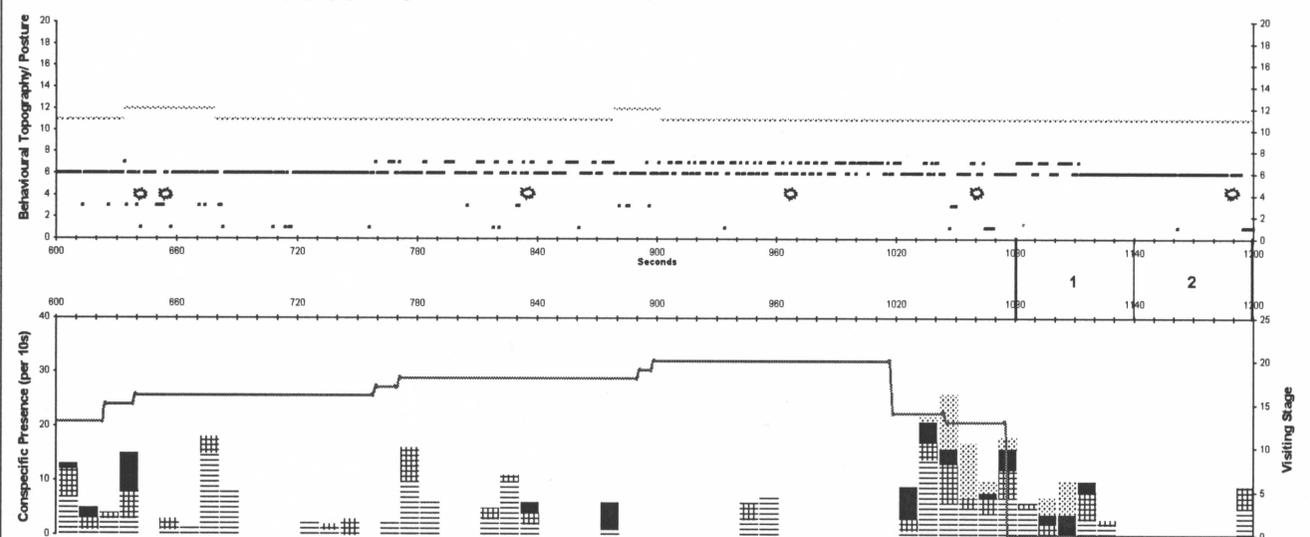
C1-3, 27.11.2000 mv: Behavioural Topography Before Human Visitation "One Person, Loud and Fast"



C1-3, 27.11.2000 mv: Conspecific Disturbance Before Human Visitation



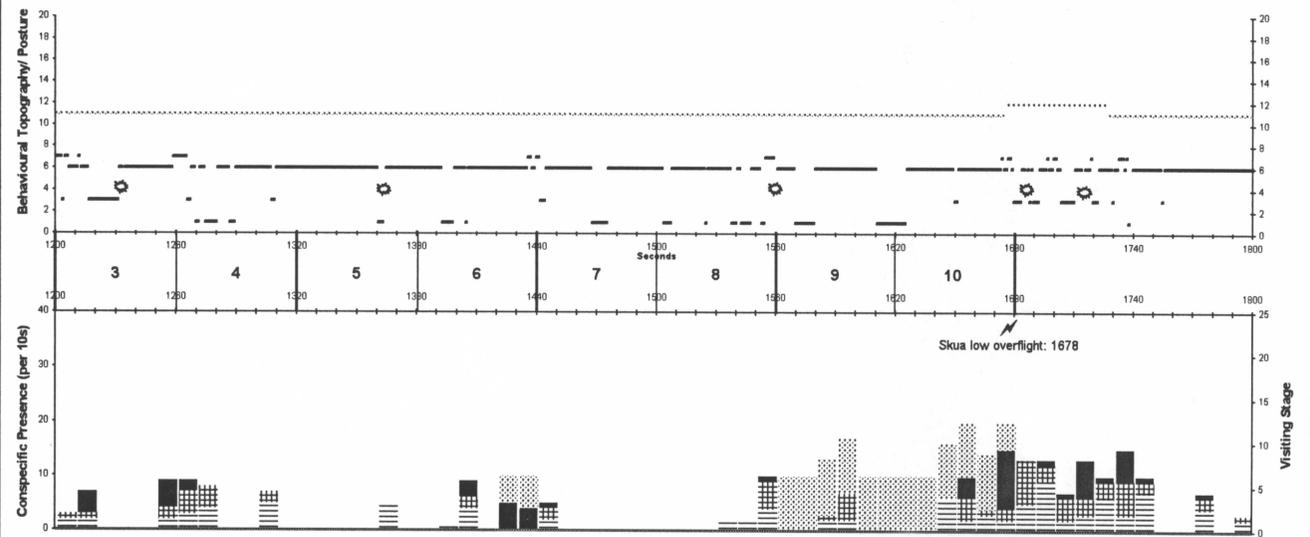
C1-3, 27.11.2000 mv: Behavioural Topography During Human Visitation "One Person, Loud and Fast"



C1-3, 27.11.2000 mv: Conspecific Disturbance During Human Visitation



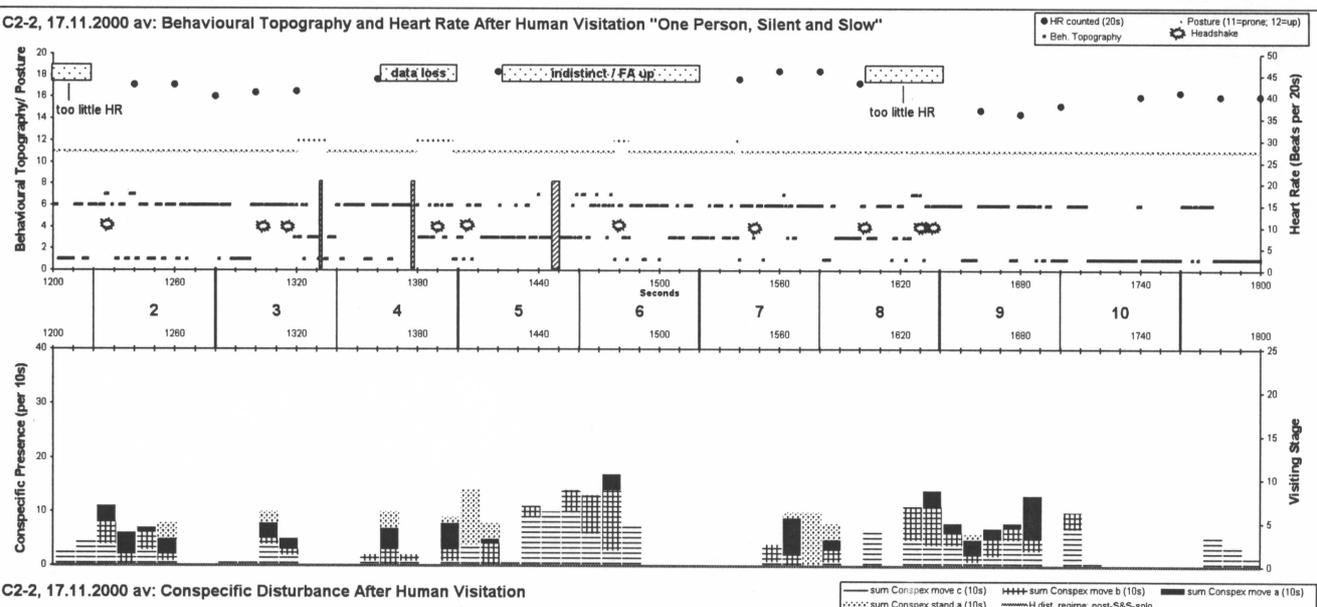
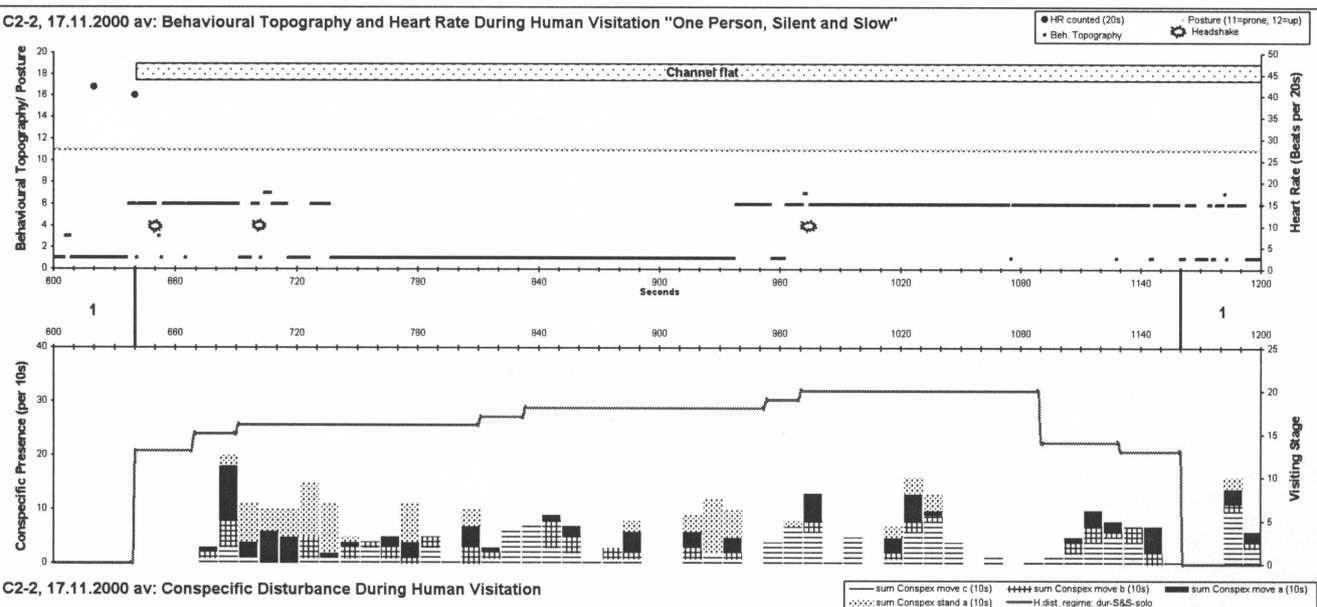
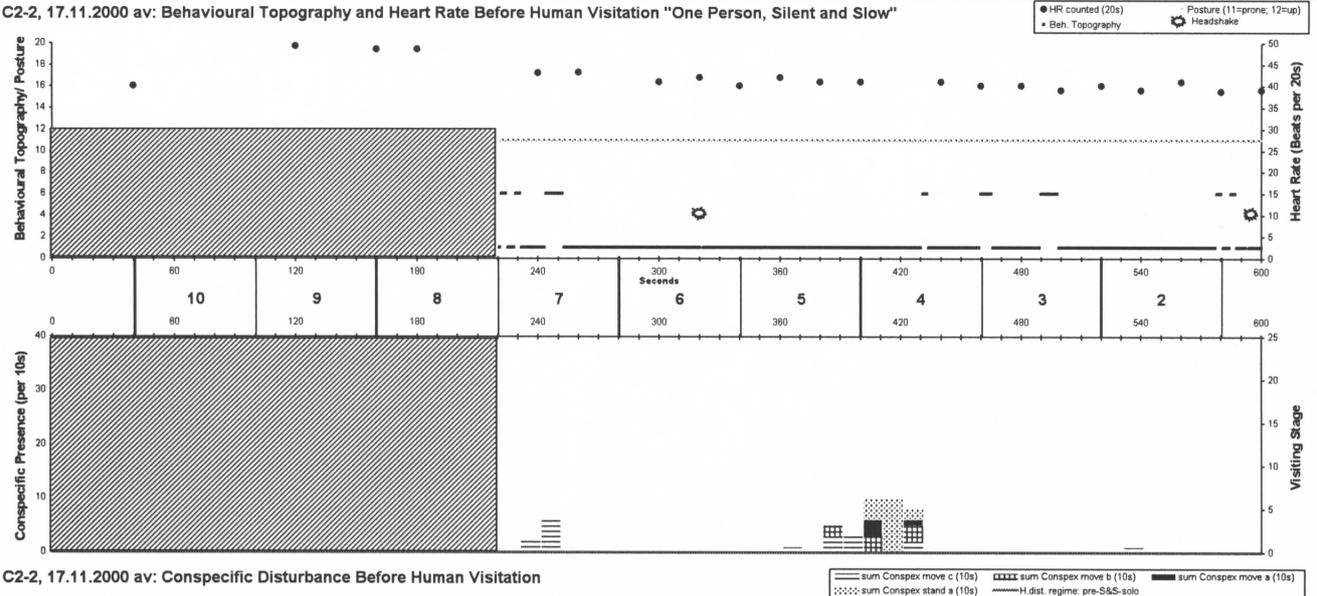
C1-3, 27.11.2000 mv: Behavioural Topography After Human Visitation "One Person, Loud and Fast"

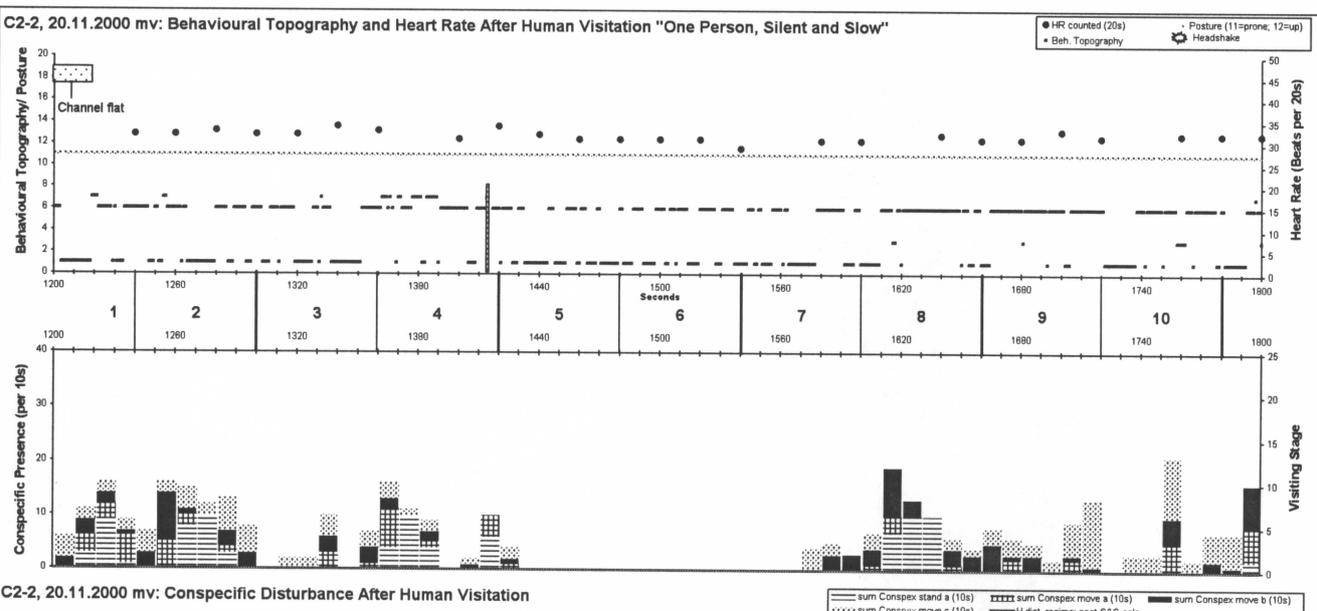
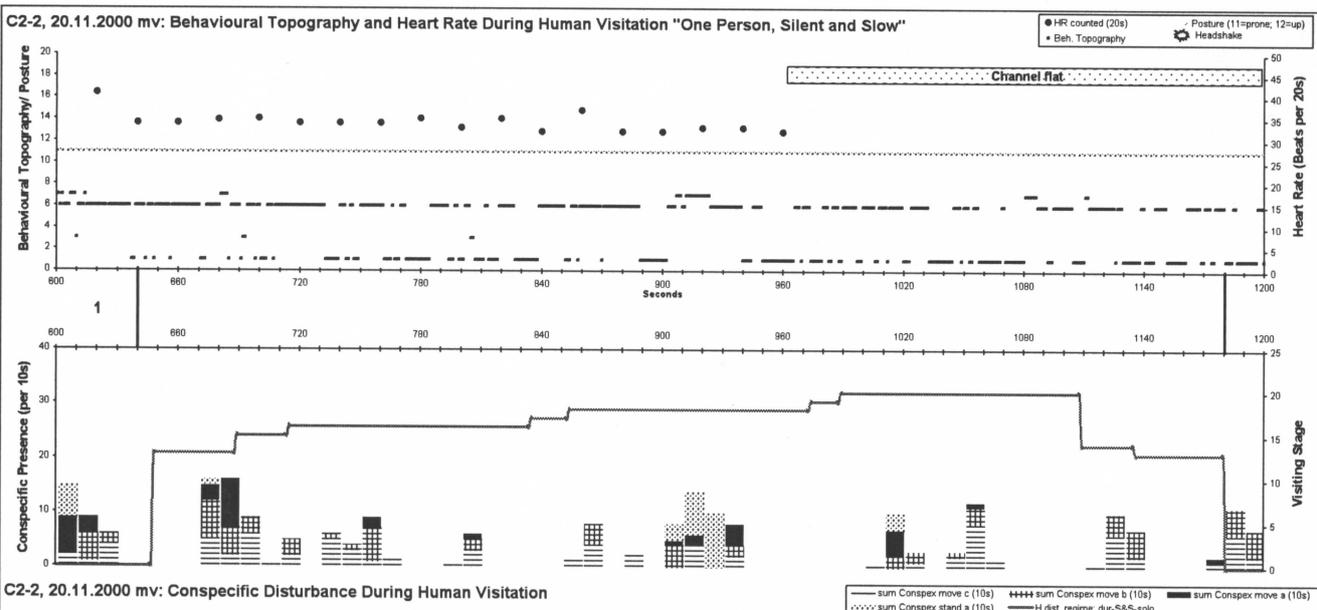
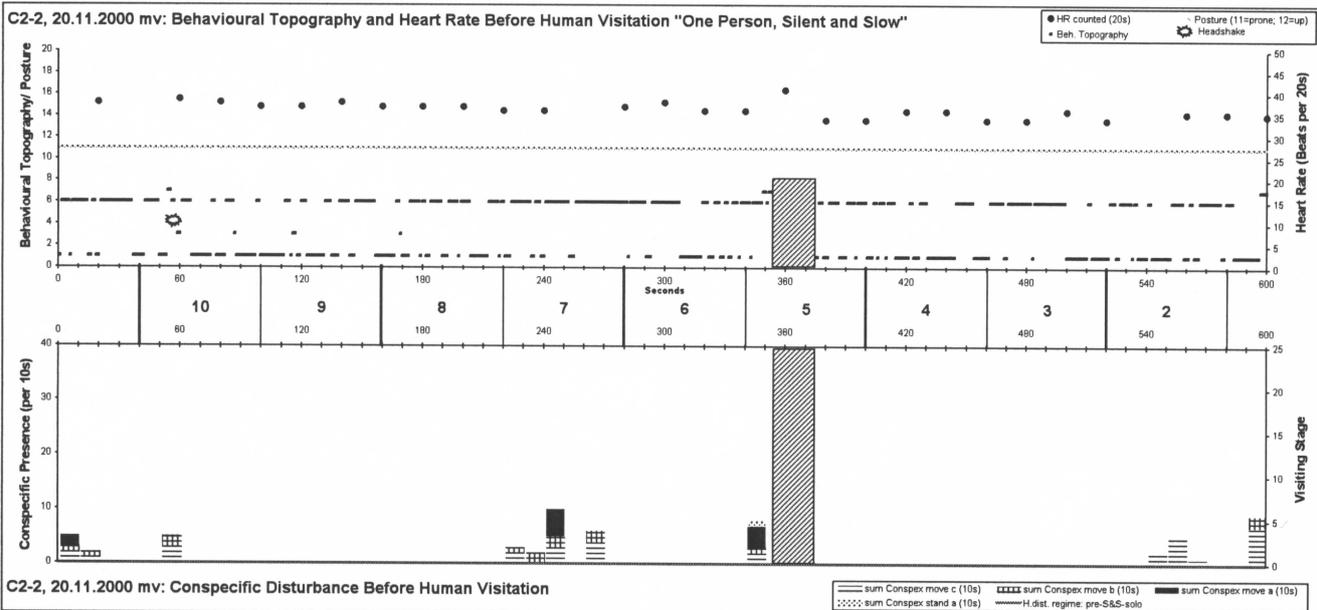


C1-3, 27.11.2000 mv: Conspecific Disturbance After Human Visitation

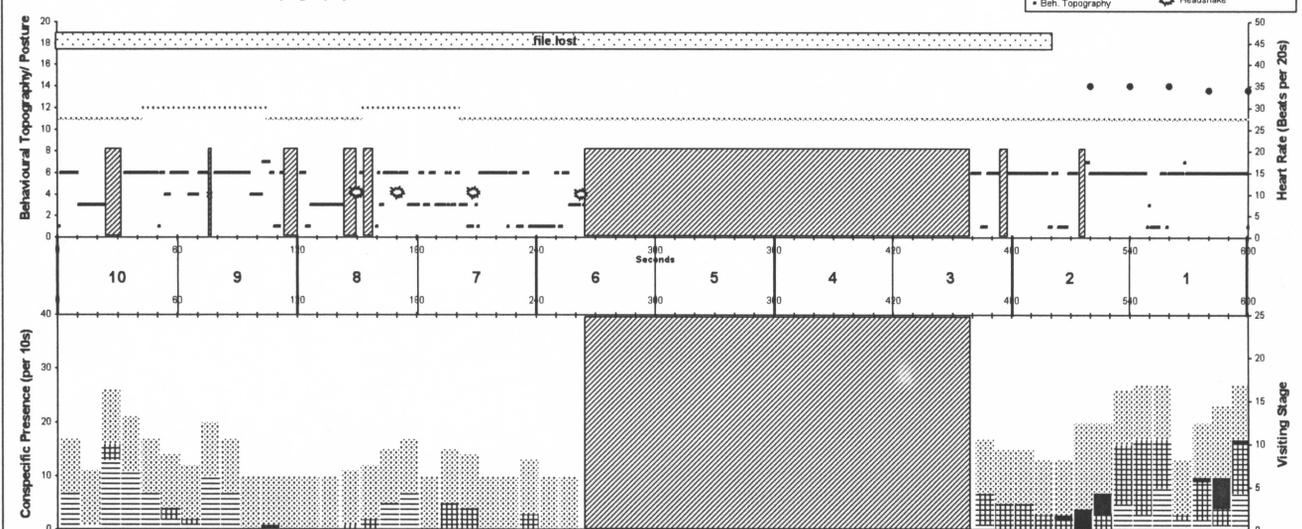


# Behavioural Topography, Heart Rate and Conspecific Disturbance before, during and after Human Visitation





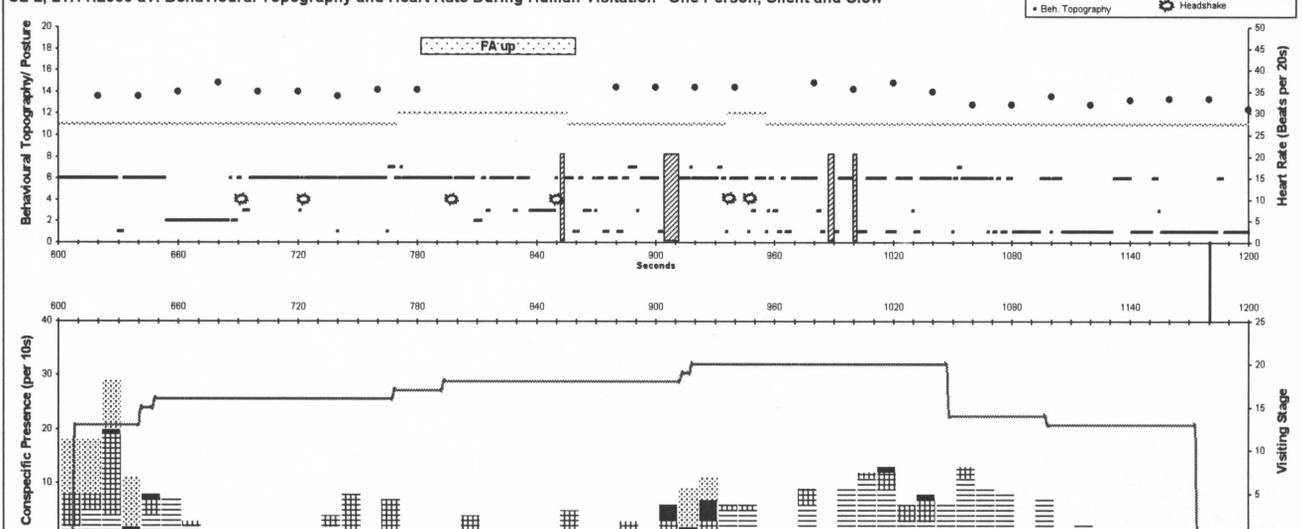
C2-2, 21.11.2000 av: Behavioural Topography and Heart Rate Before Human Visitation "One Person, Silent and Slow"



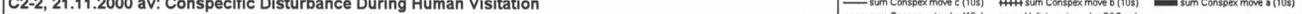
C2-2, 21.11.2000 av: Conspecific Disturbance Before Human Visitation



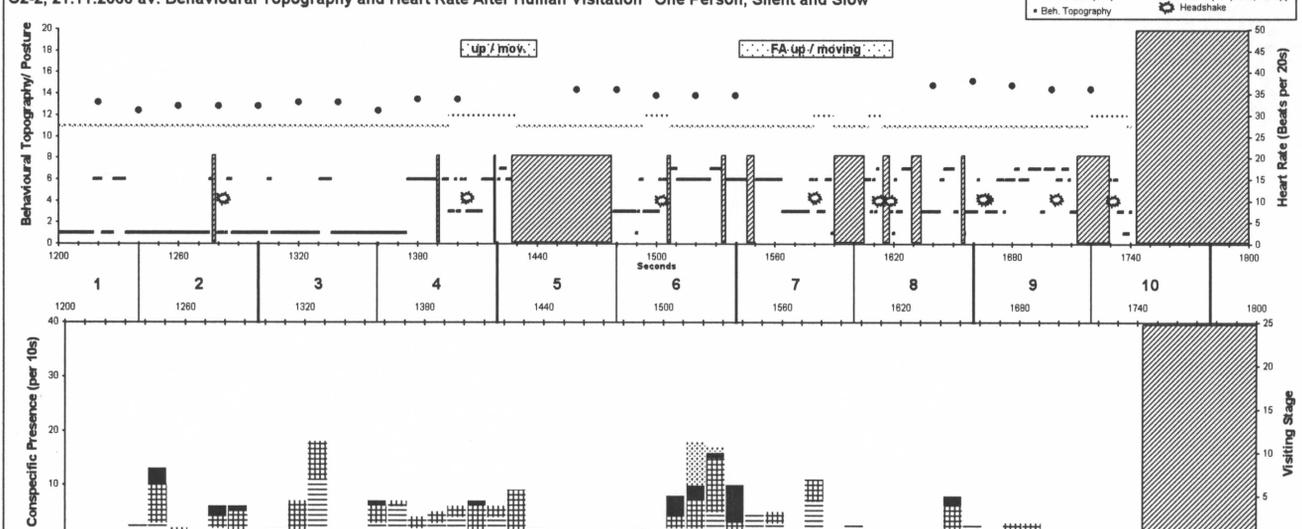
C2-2, 21.11.2000 av: Behavioural Topography and Heart Rate During Human Visitation "One Person, Silent and Slow"



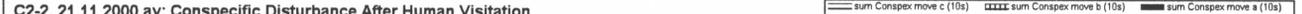
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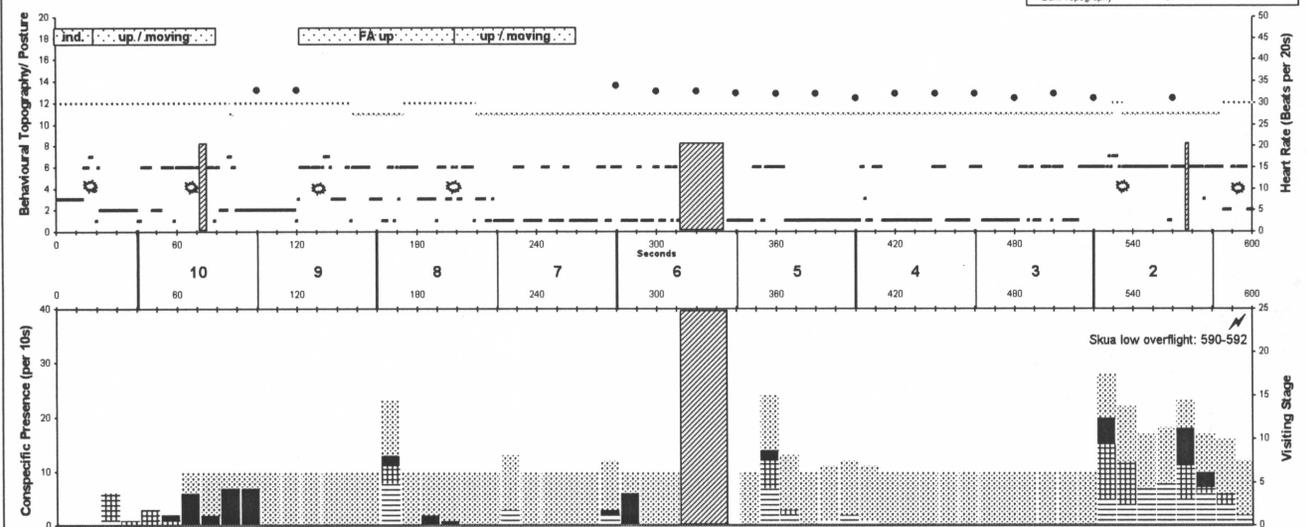
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C2-2, 21.11.2000 av: Conspecific Disturbance After Human Visitation

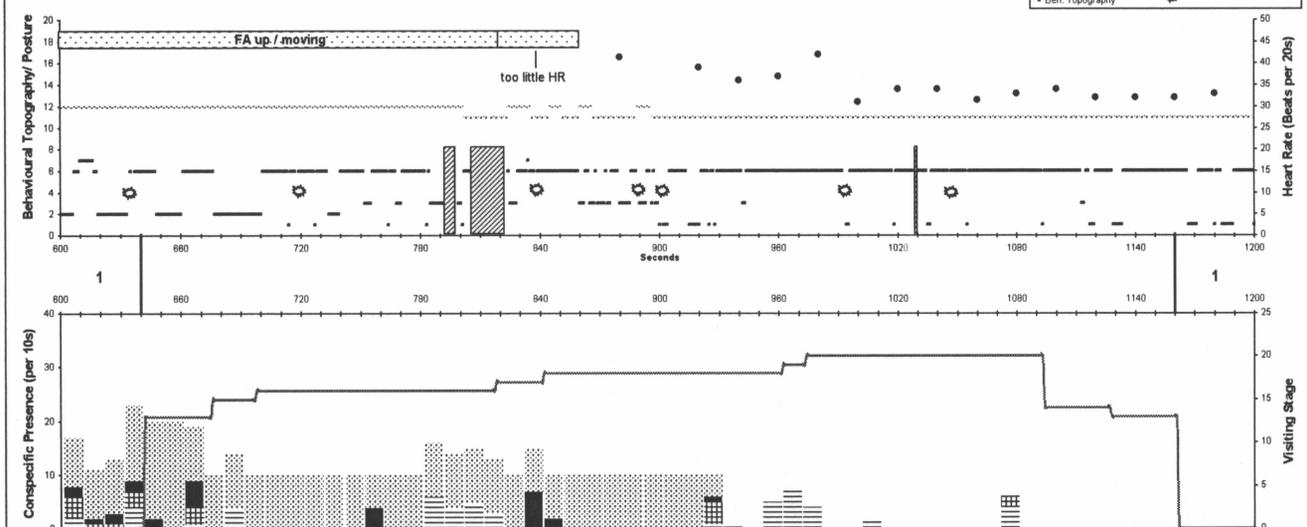


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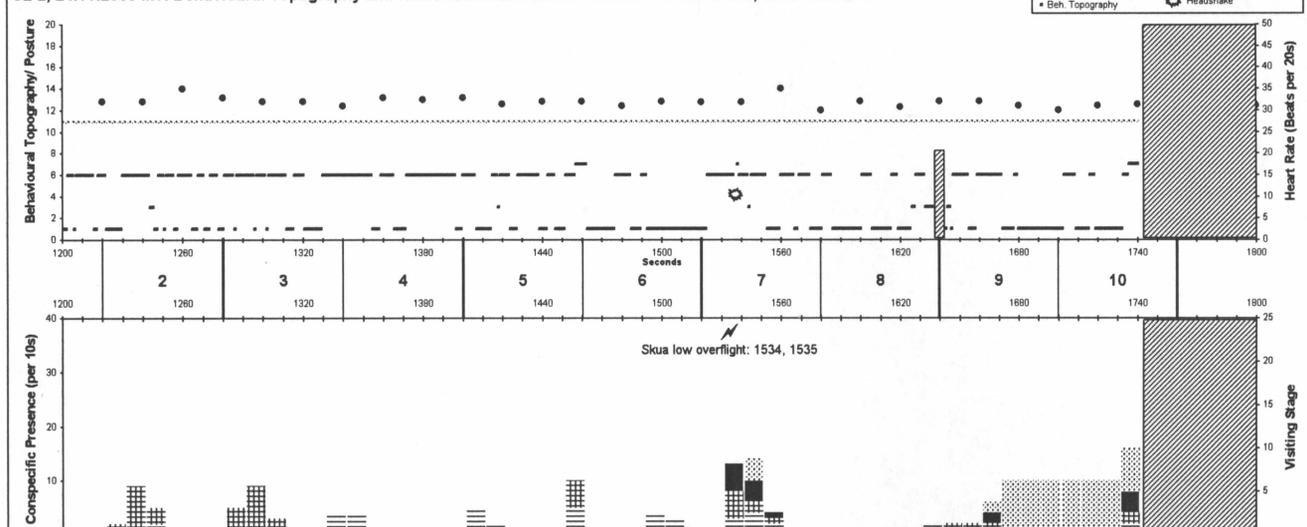
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C2-2, 24.11.2000 mv: Behavioural Topography and Heart Rate During Human Visitation "One Person, Silent and Slow"



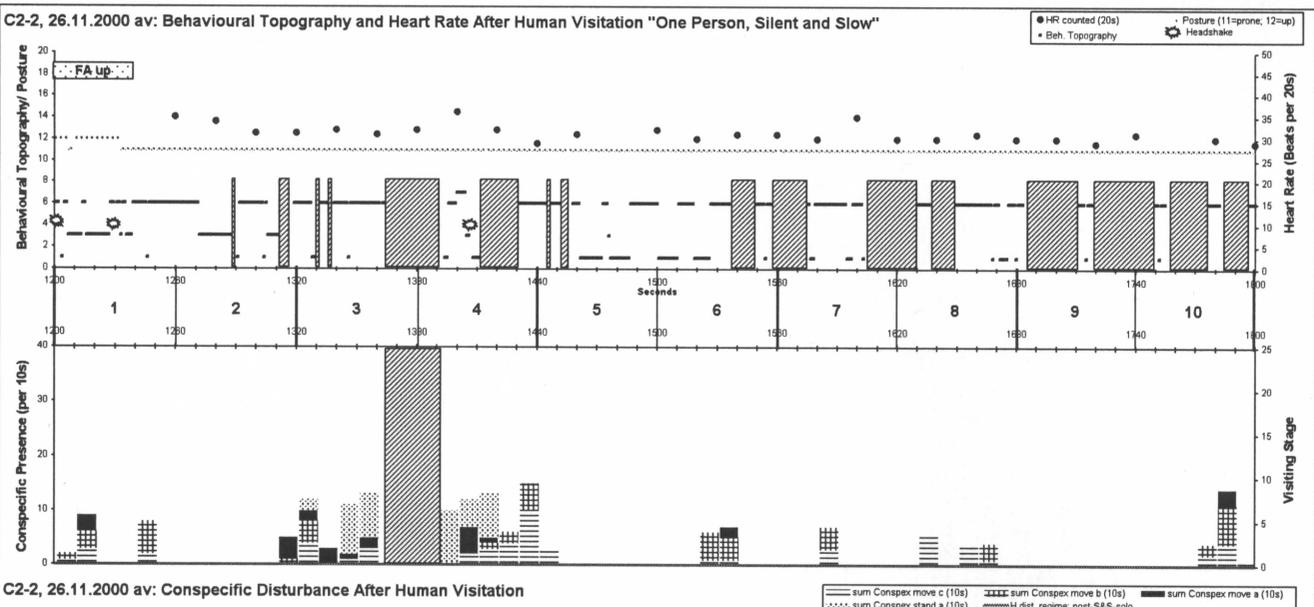
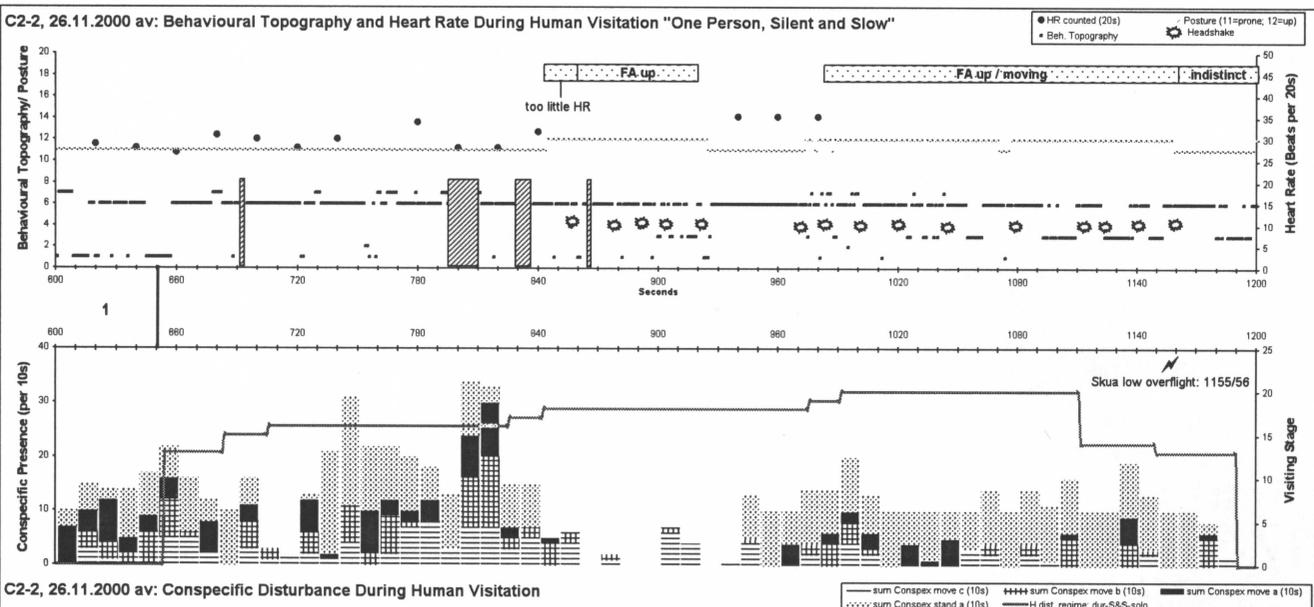
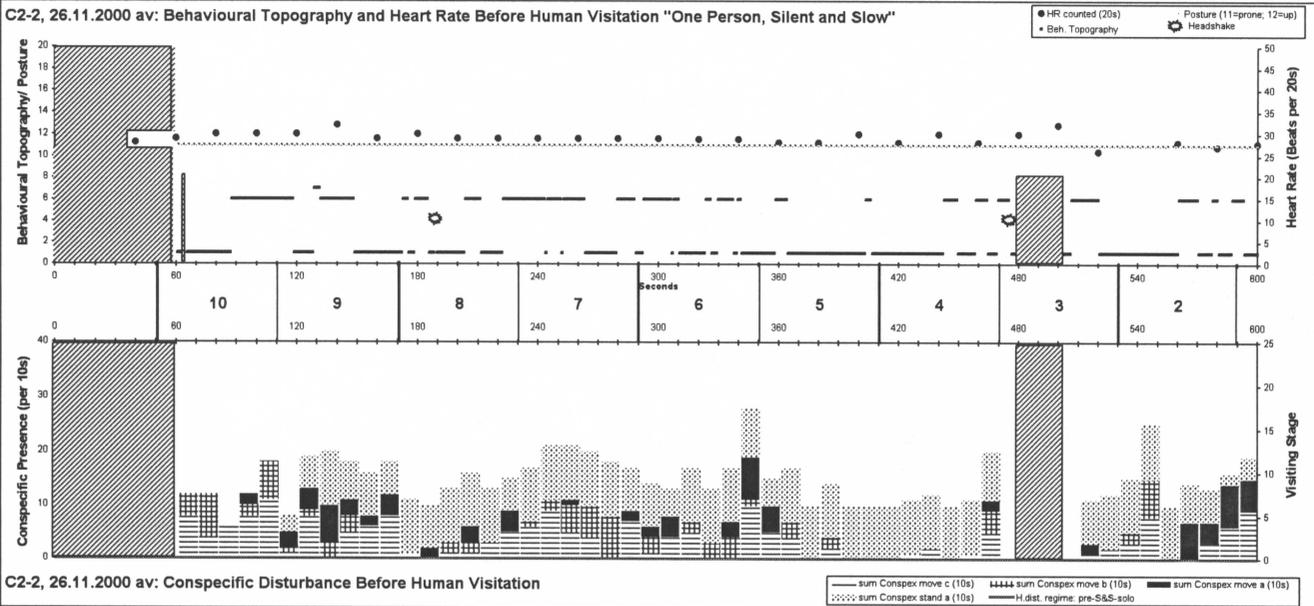
C2-2, 24.11.2000 mv: Conspecific Disturbance During Human Visitation

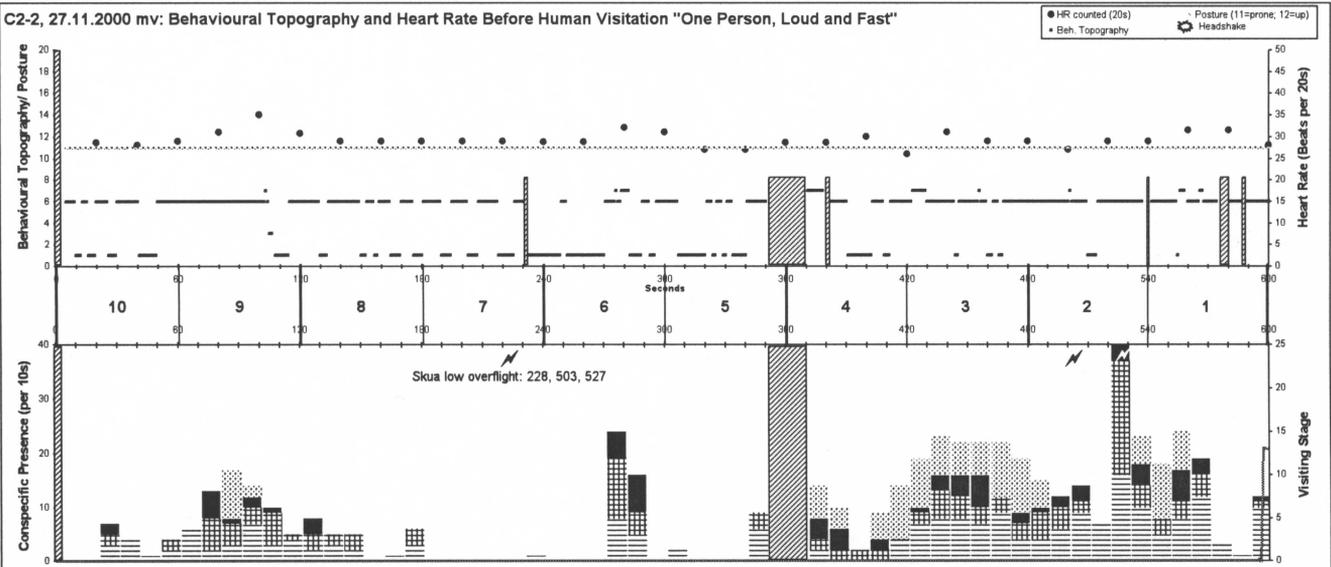
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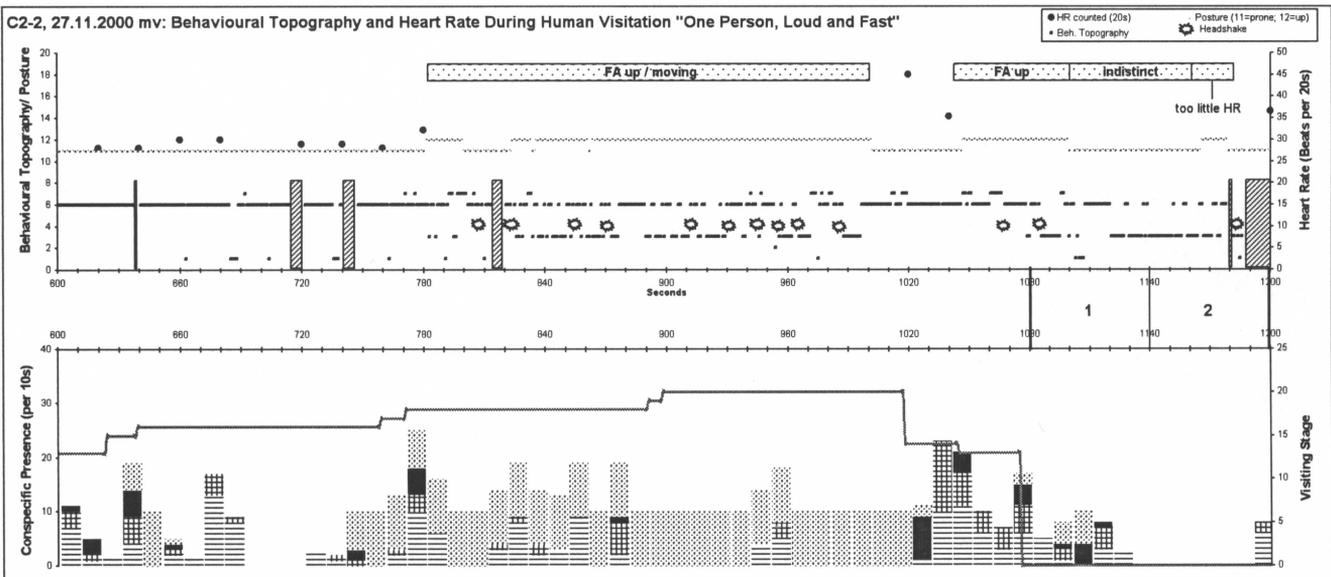
C2-2, 24.11.2000 mv: Conspecific Disturbance After Human Visitation

# Behavioural Topography, Heart Rate and Conspecific Disturbance before, during and after Human Visitation

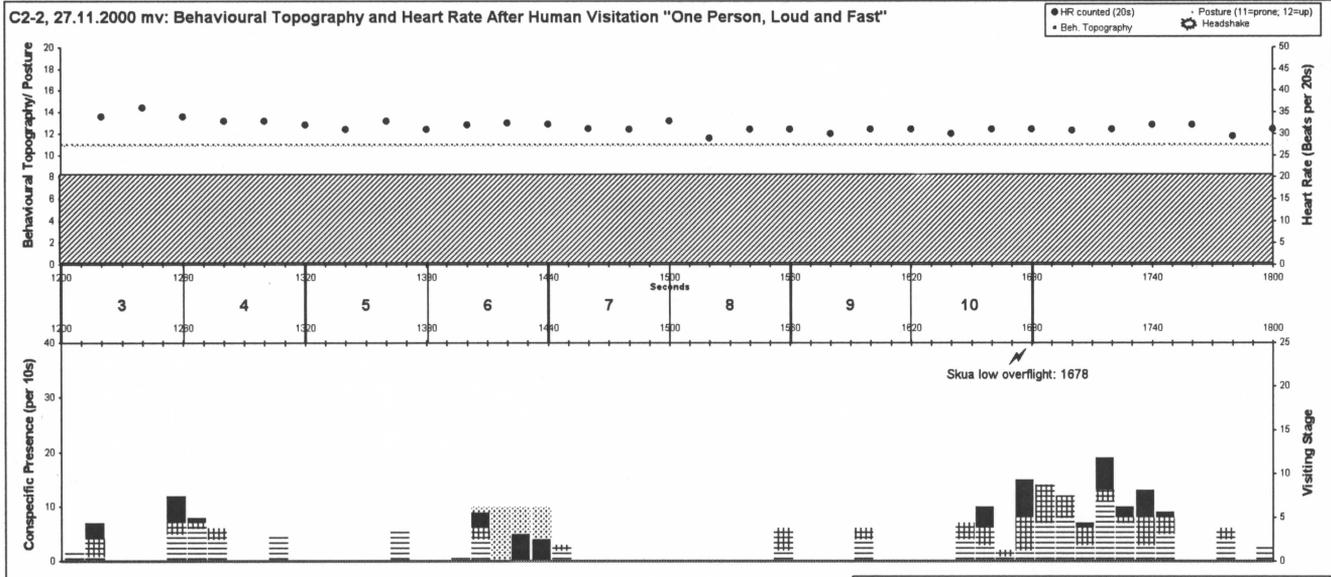




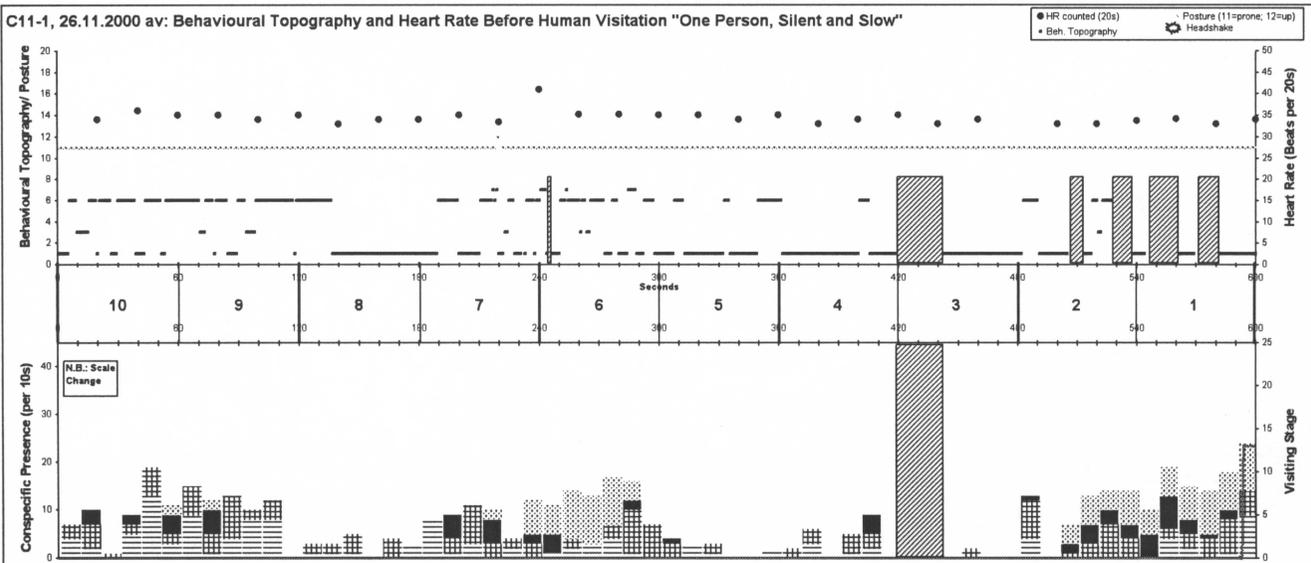
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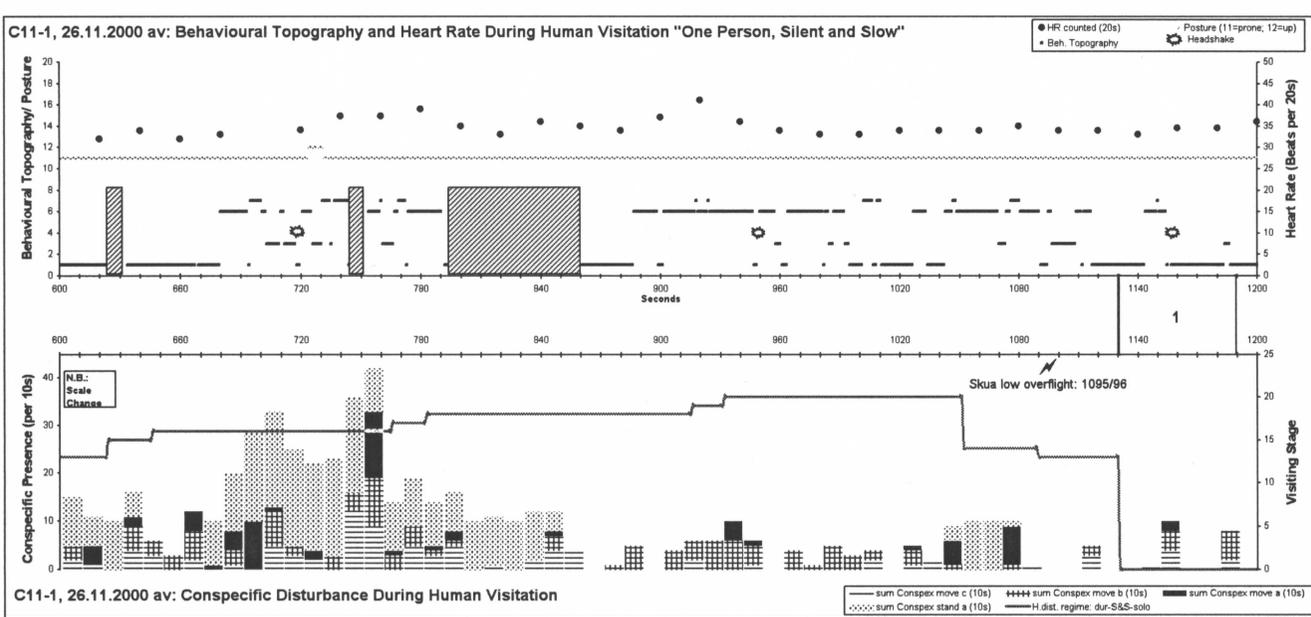
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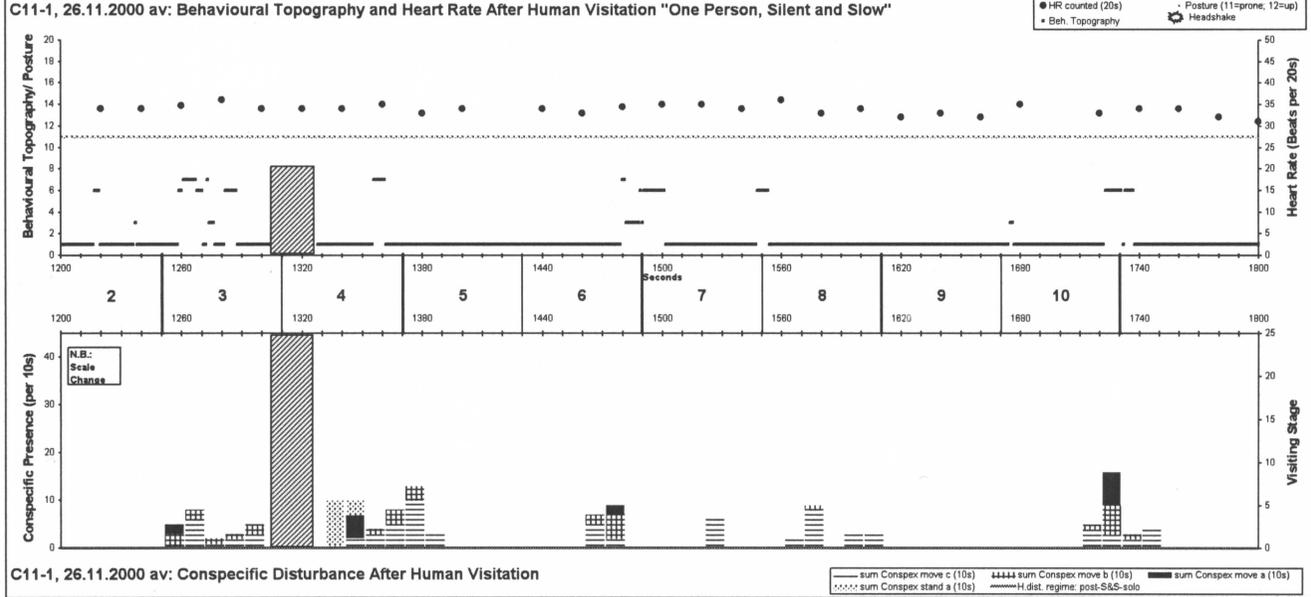
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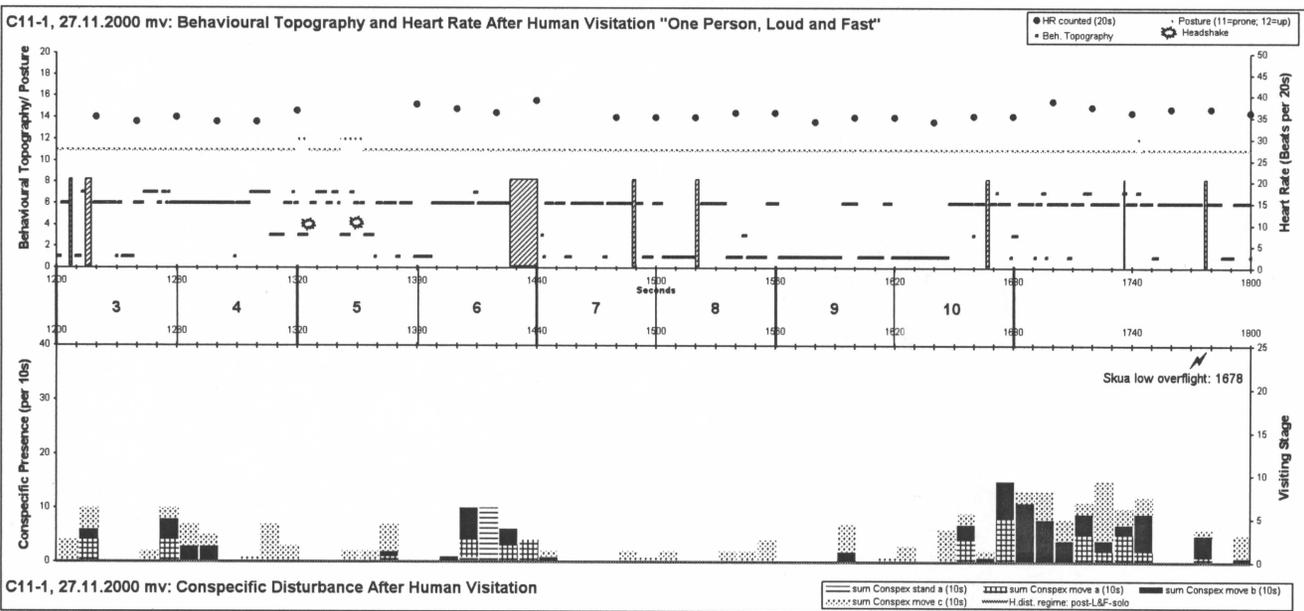
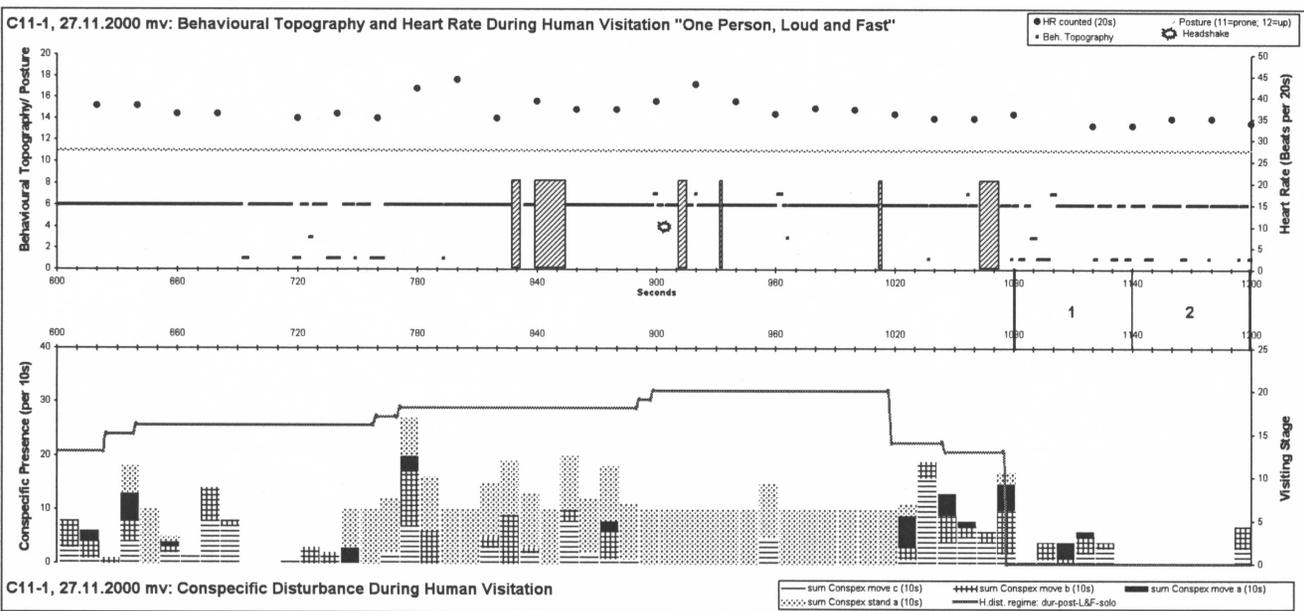
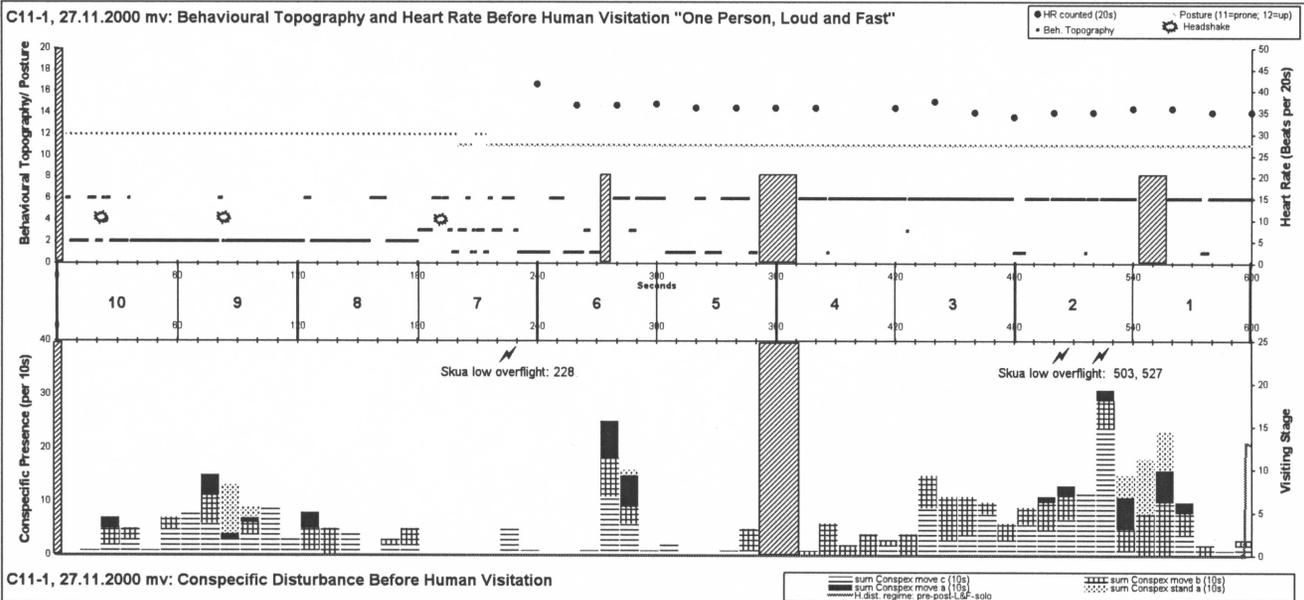
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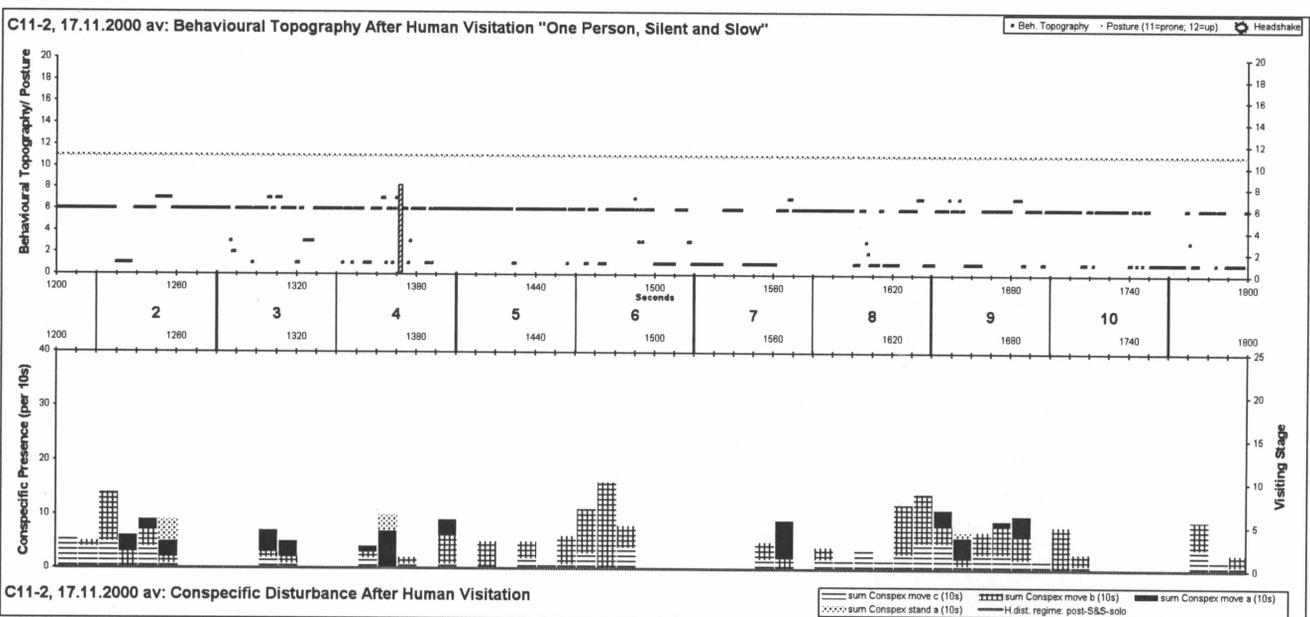
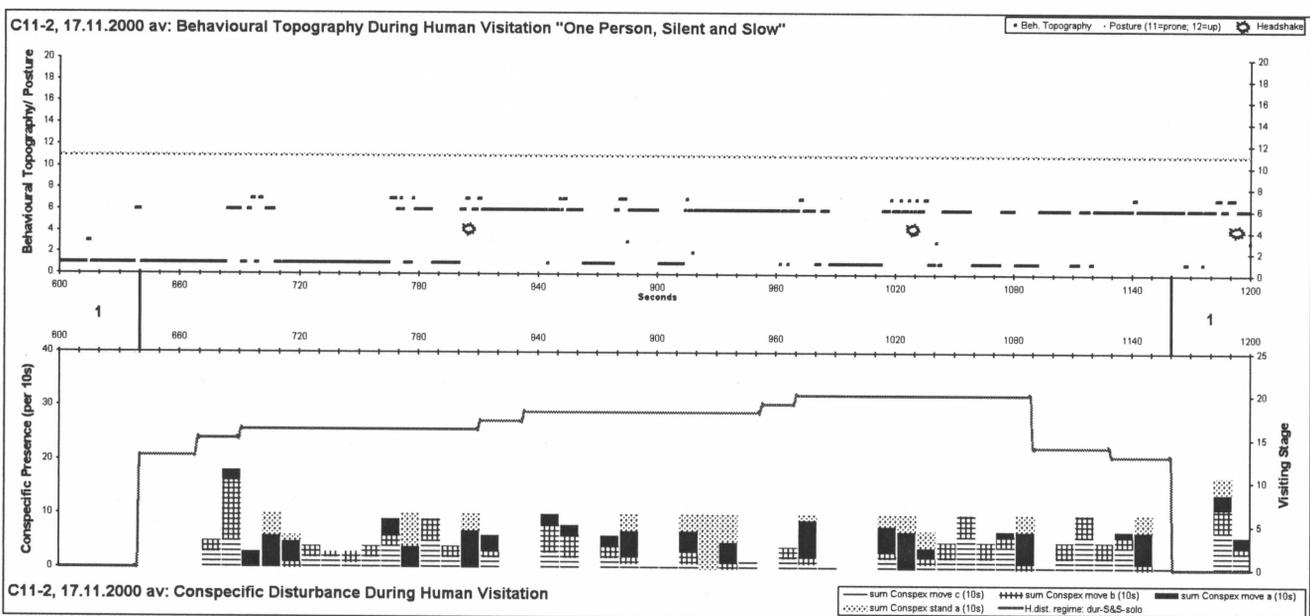
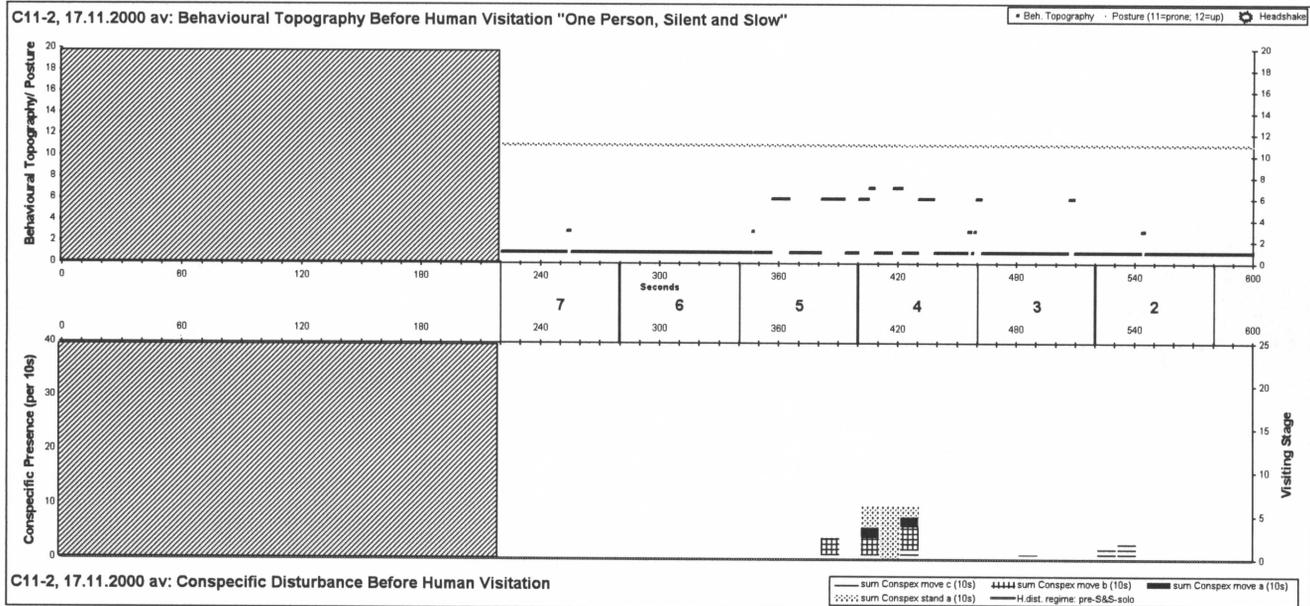


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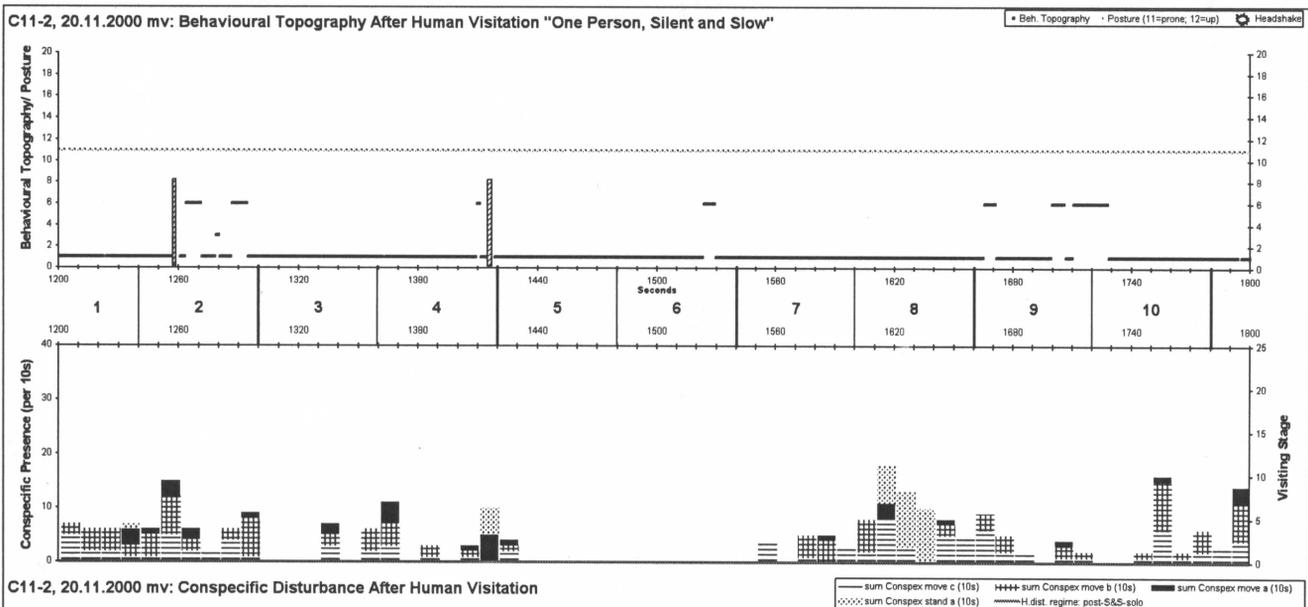
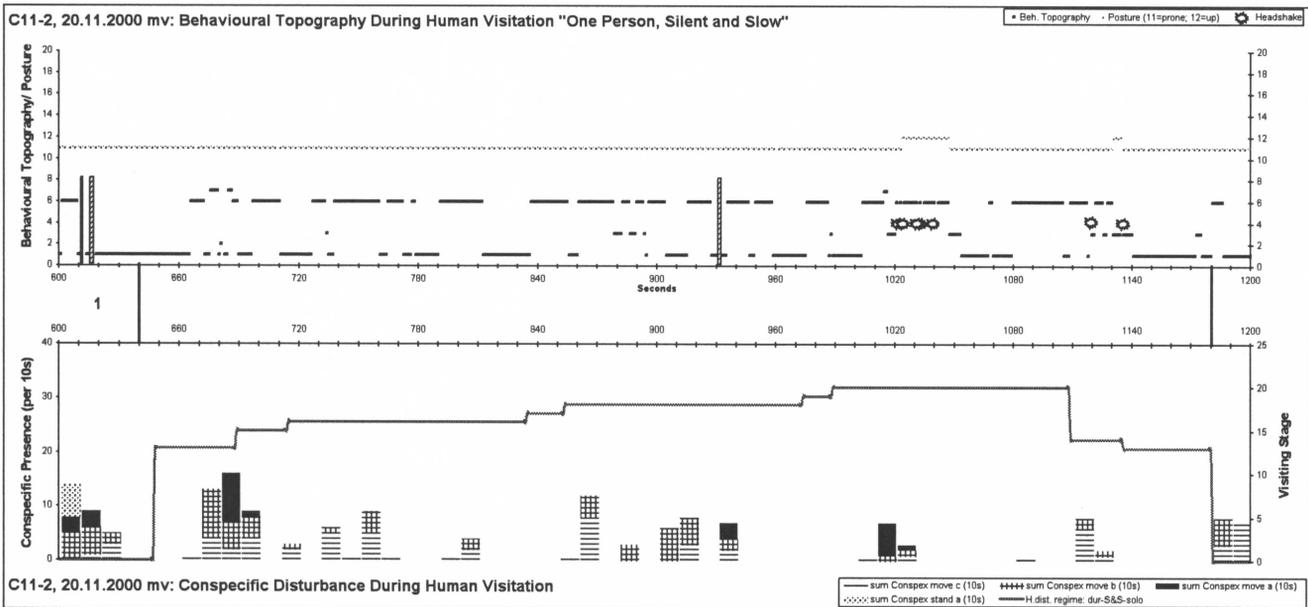
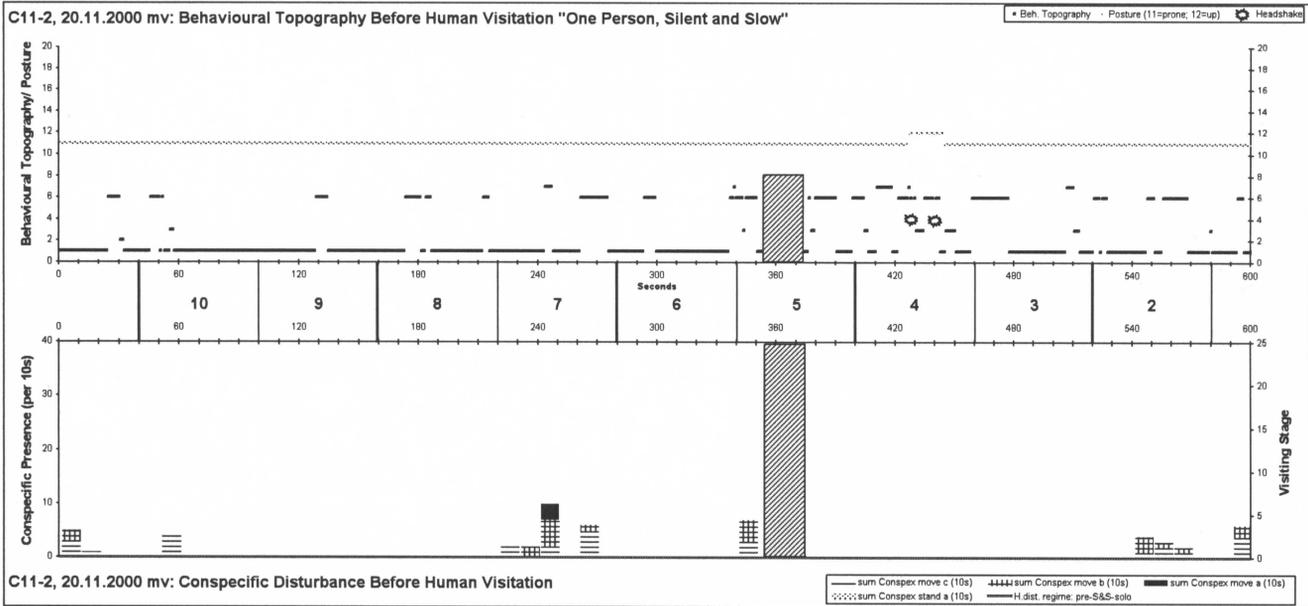


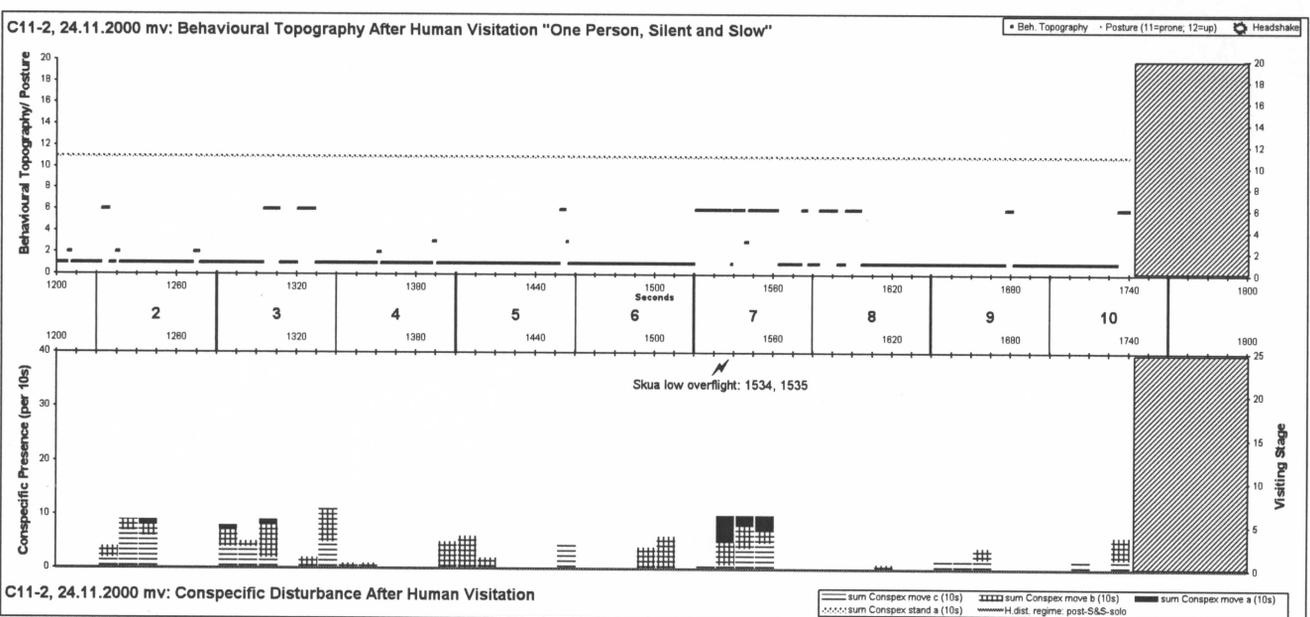
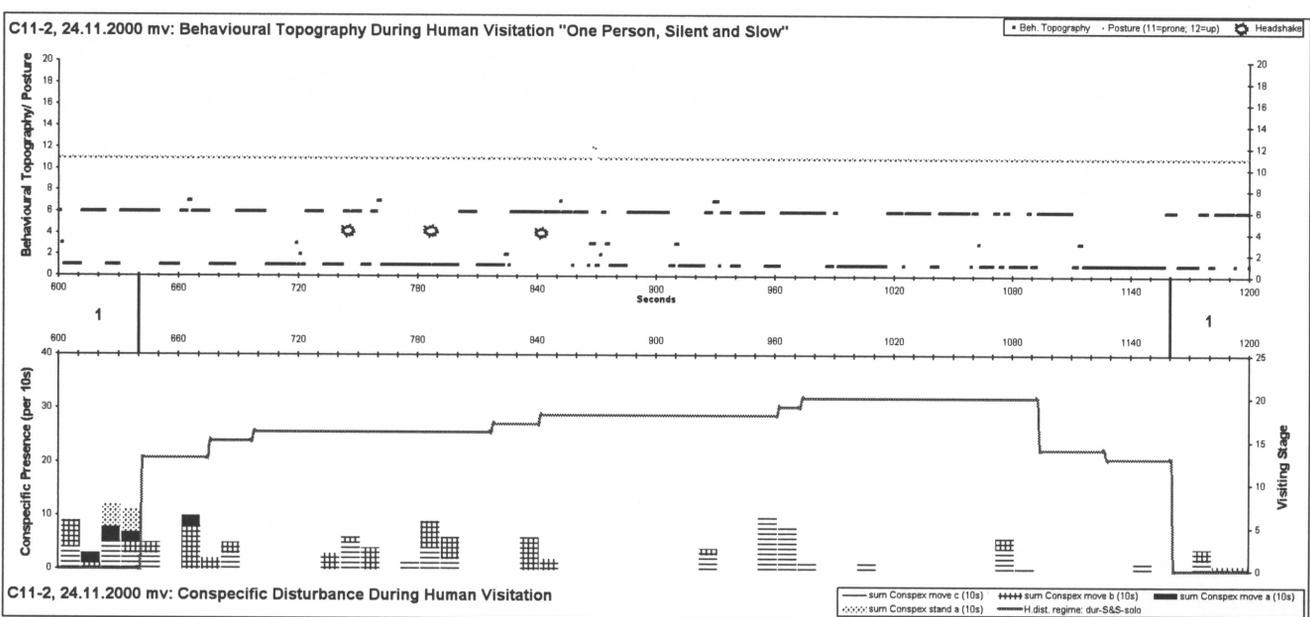
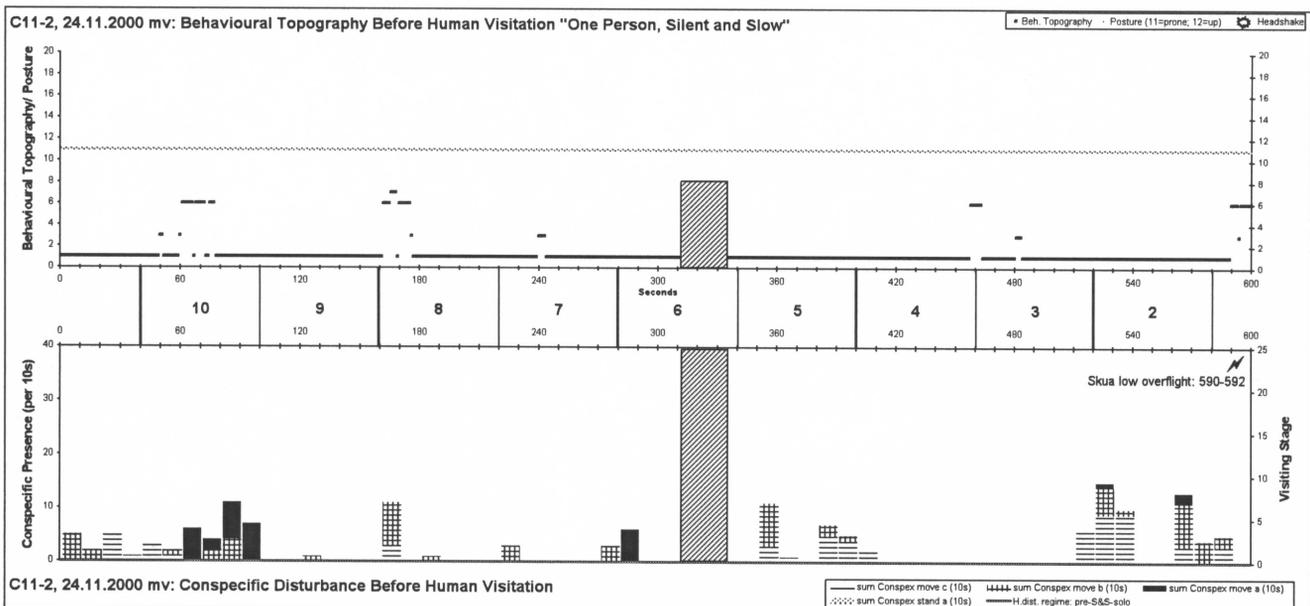
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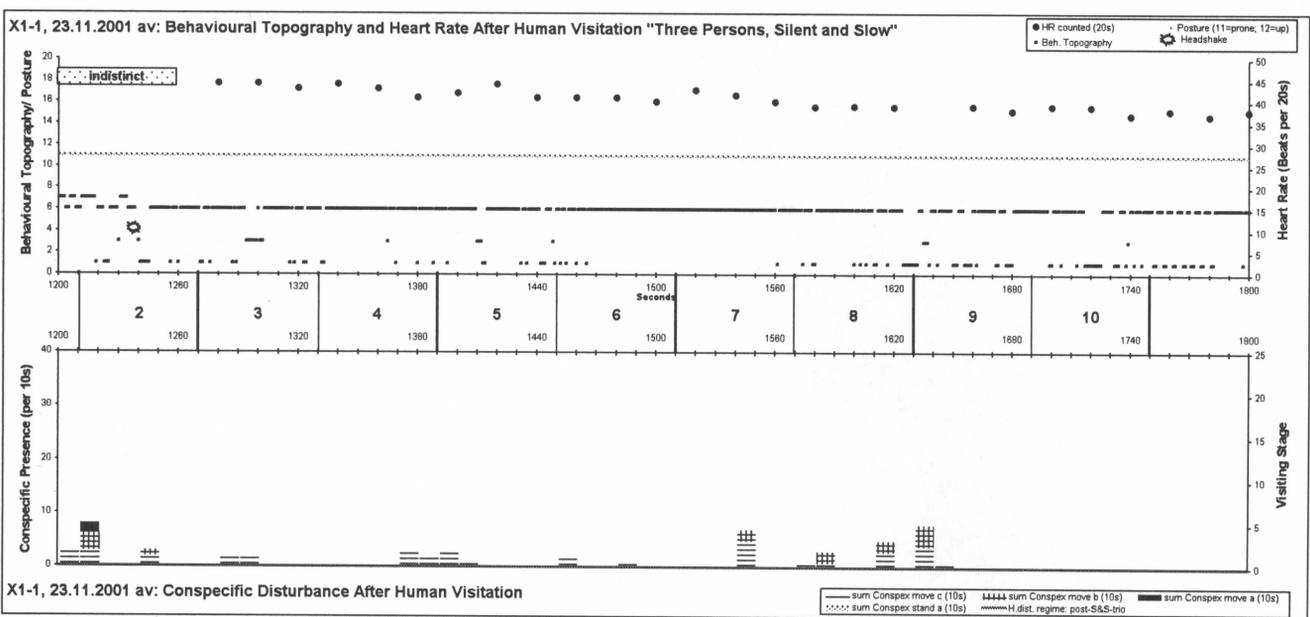
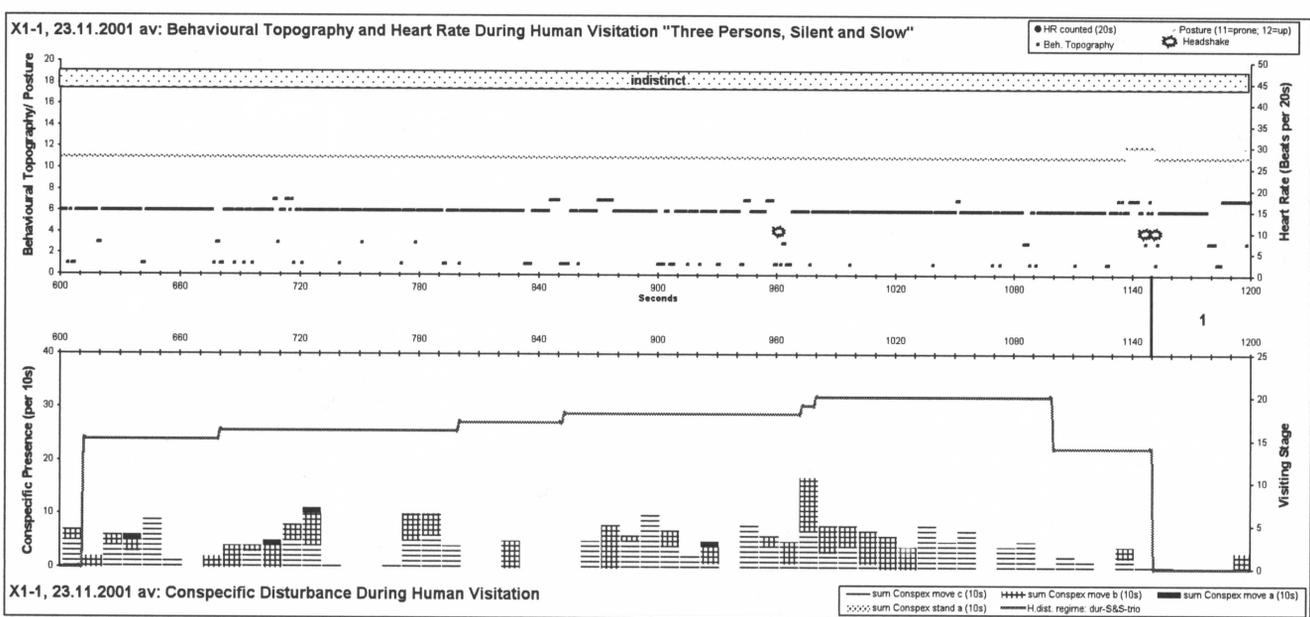
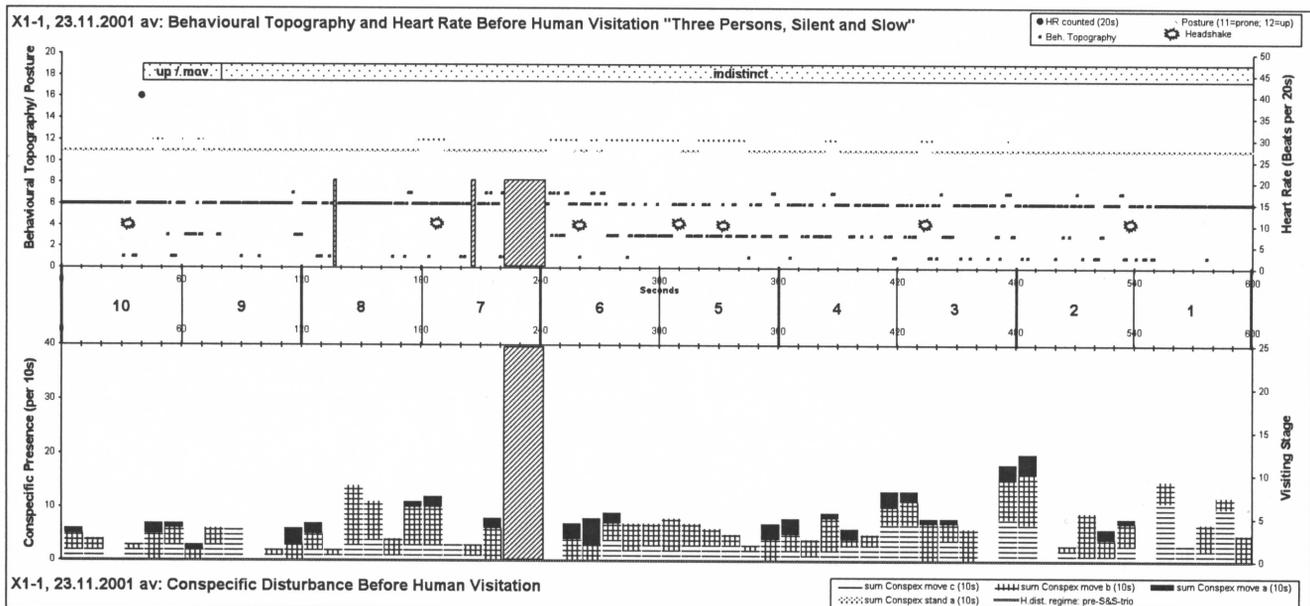


# Behavioural Topography and Conspecific Disturbance before, during and after Human Visitation

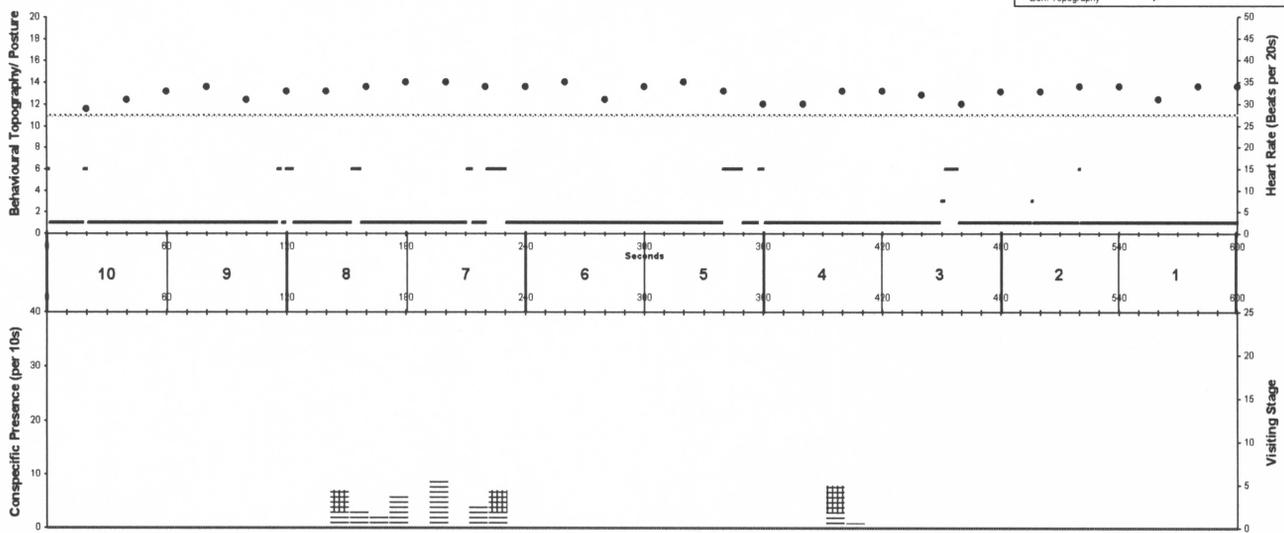




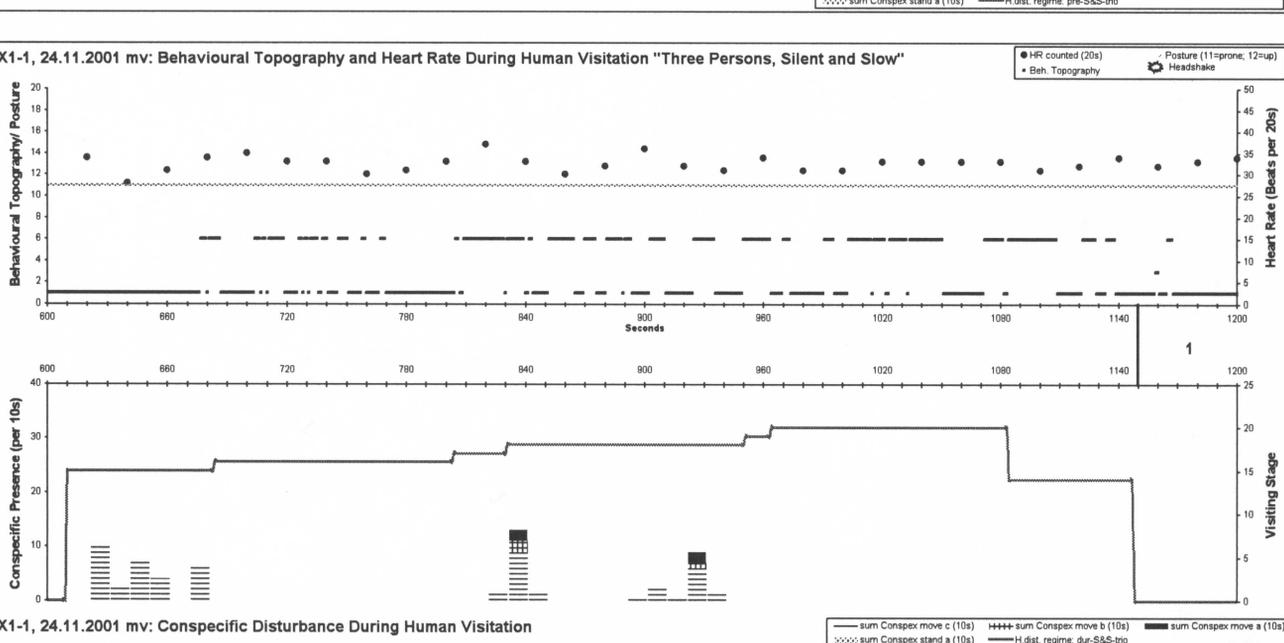
# Behavioural Topography, Heart Rate and Conspecific Disturbance before, during and after Human Visitation



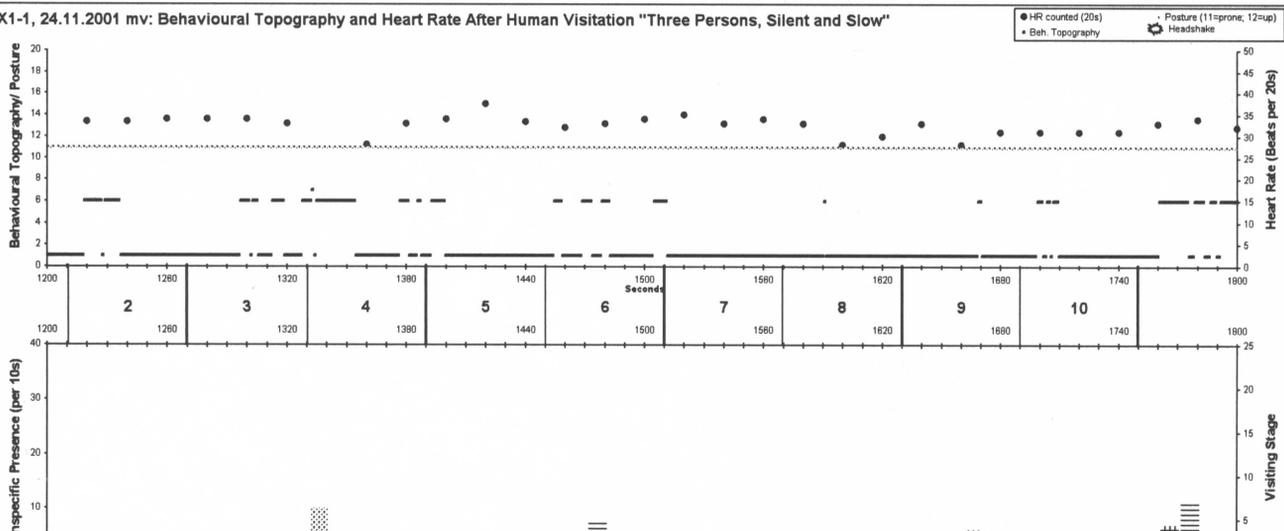
X1-1, 24.11.2001 mv: Behavioural Topography and Heart Rate Before Human Visitation "Three Persons, Silent and Slow"



X1-1, 24.11.2001 mv: Conspecific Disturbance Before Human Visitation



X1-1, 24.11.2001 mv: Behavioural Topography and Heart Rate During Human Visitation "Three Persons, Silent and Slow"



X1-1, 24.11.2001 mv: Conspecific Disturbance During Human Visitation



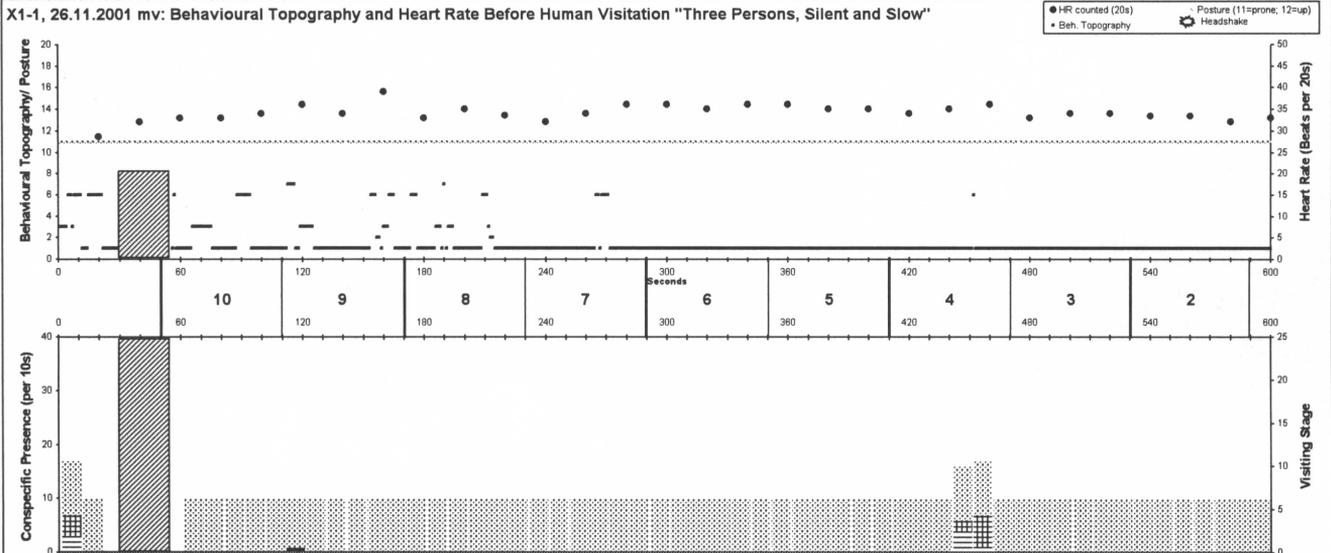
X1-1, 24.11.2001 mv: Behavioural Topography and Heart Rate After Human Visitation "Three Persons, Silent and Slow"



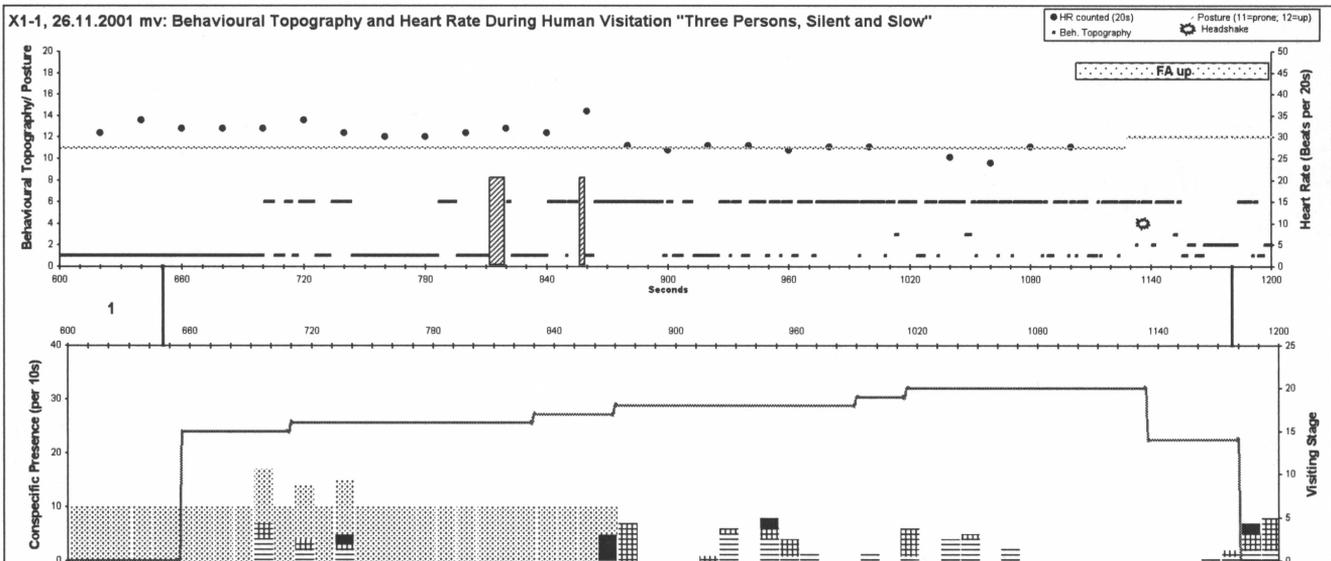
X1-1, 24.11.2001 mv: Conspecific Disturbance After Human Visitation



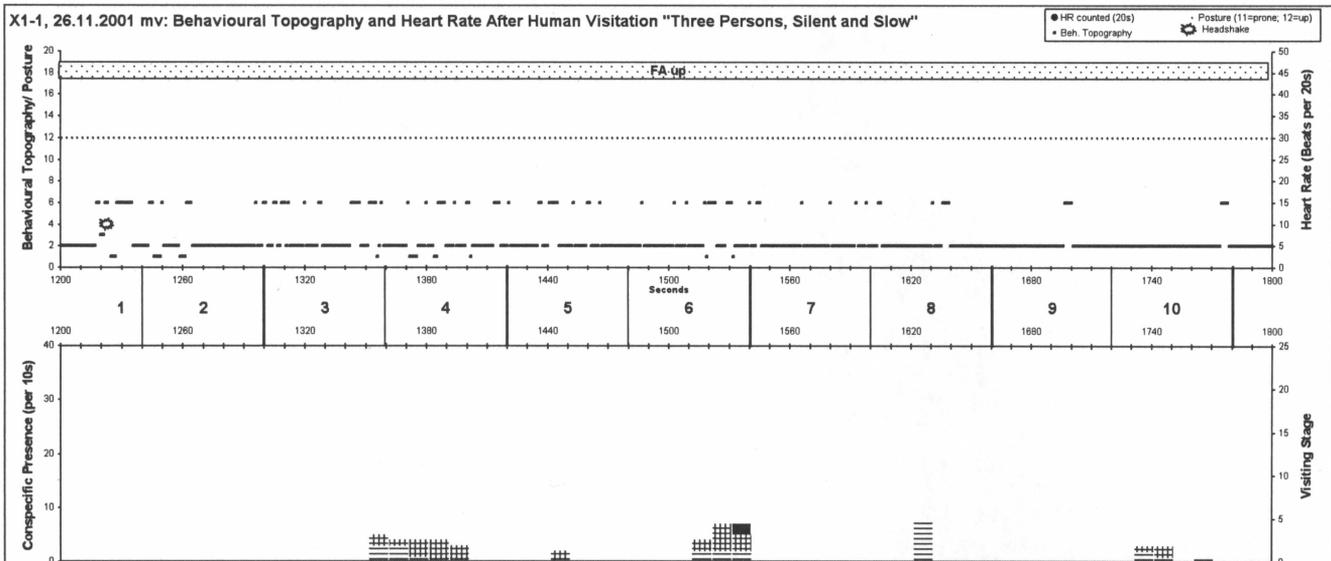
# Behavioural Topography, Heart Rate and Conspecific Disturbance before, during and after Human Visitation



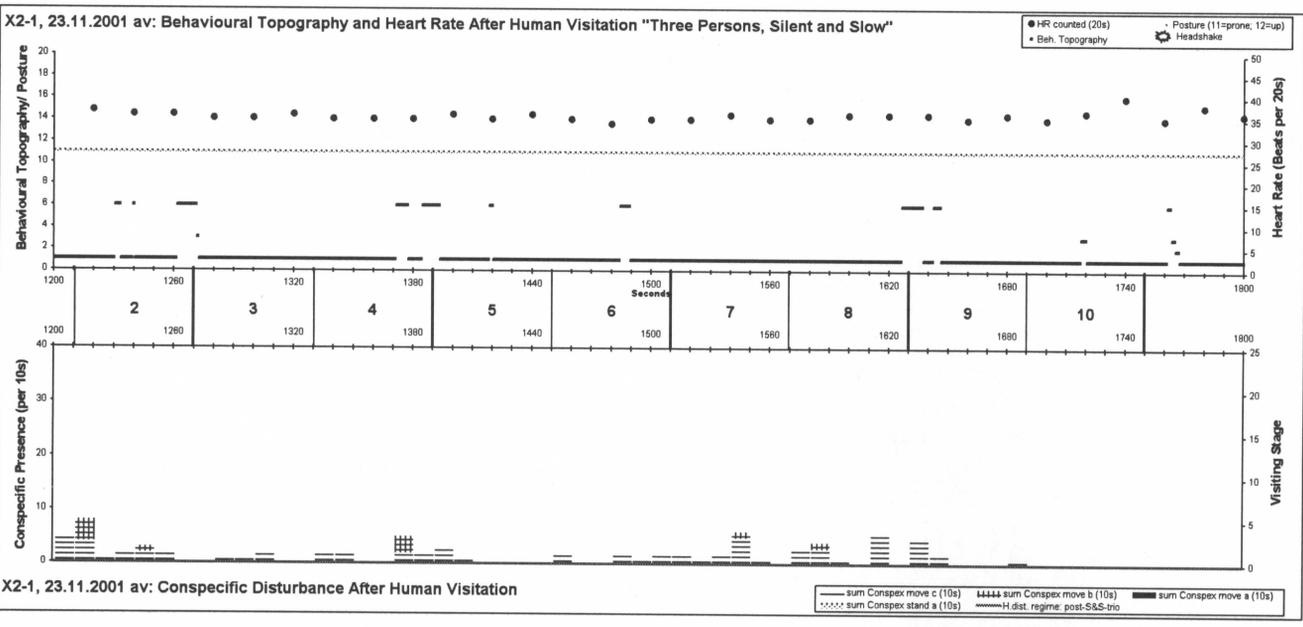
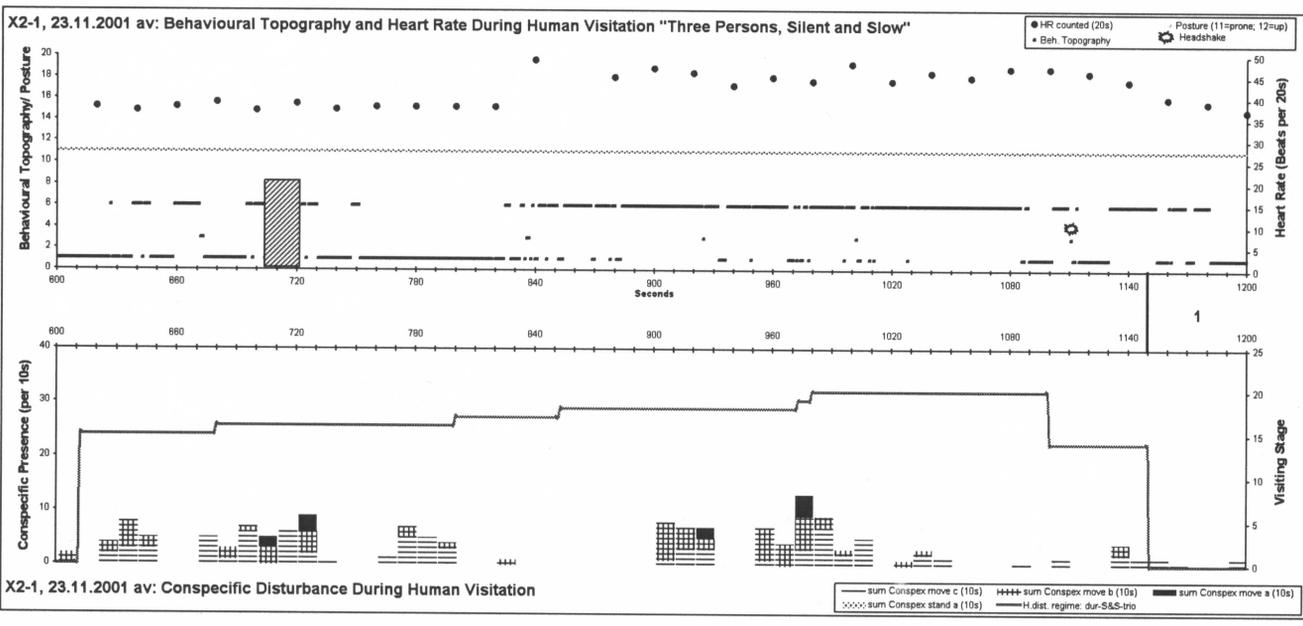
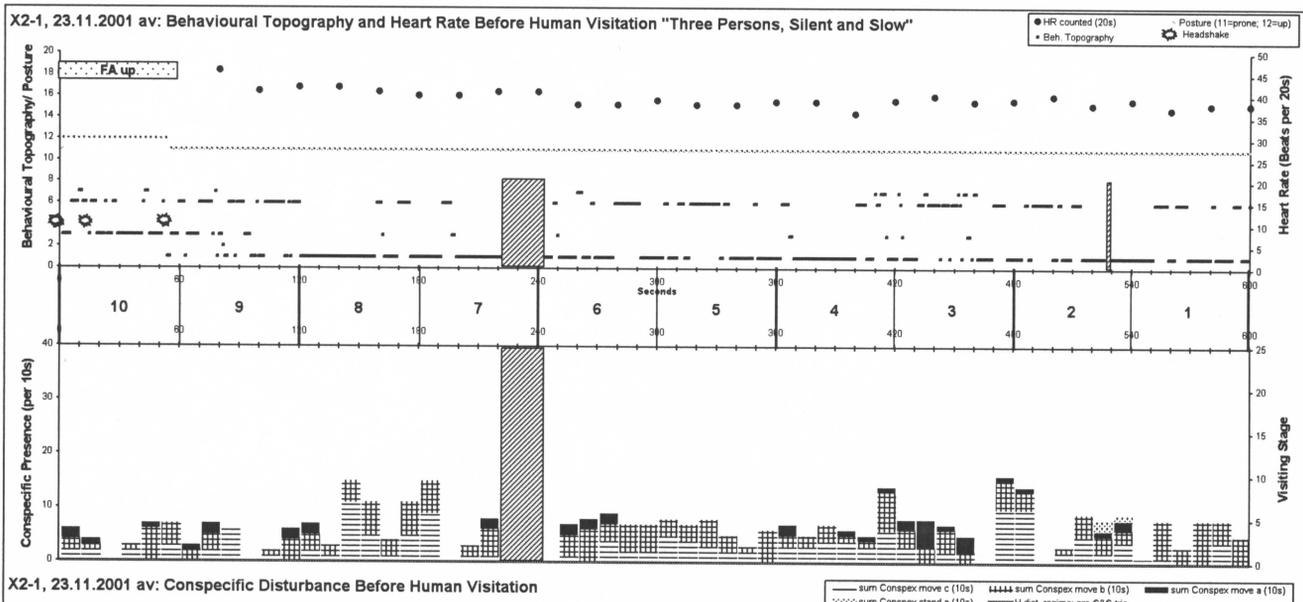
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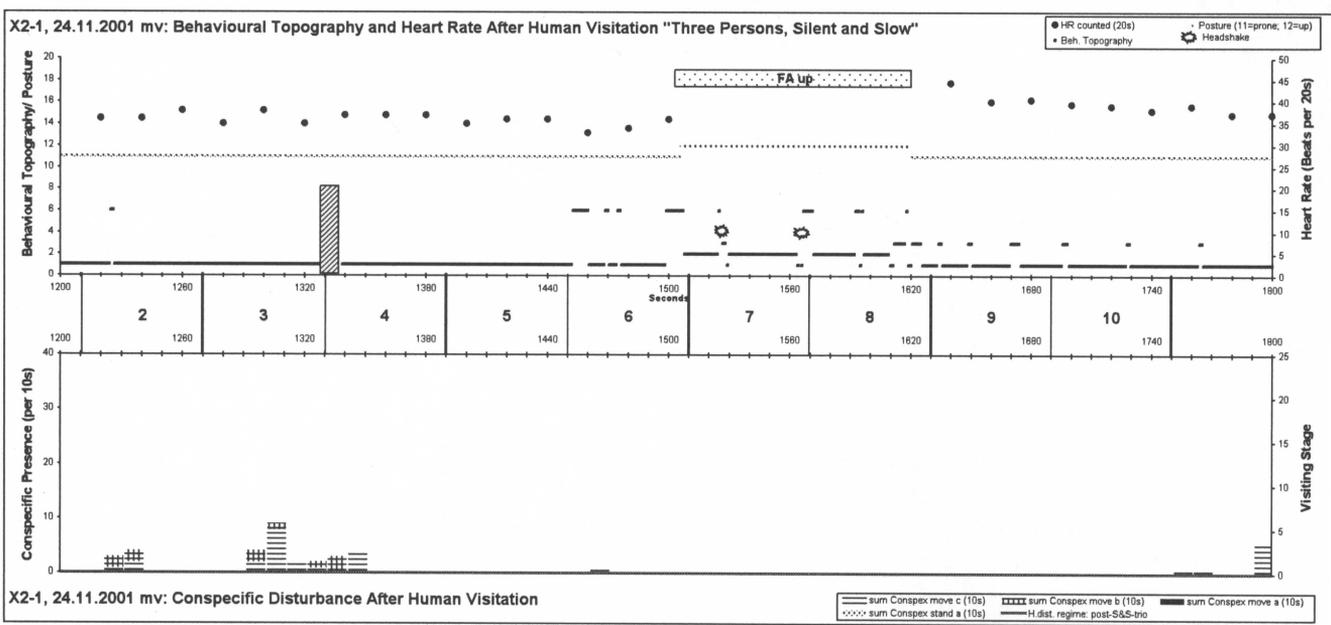
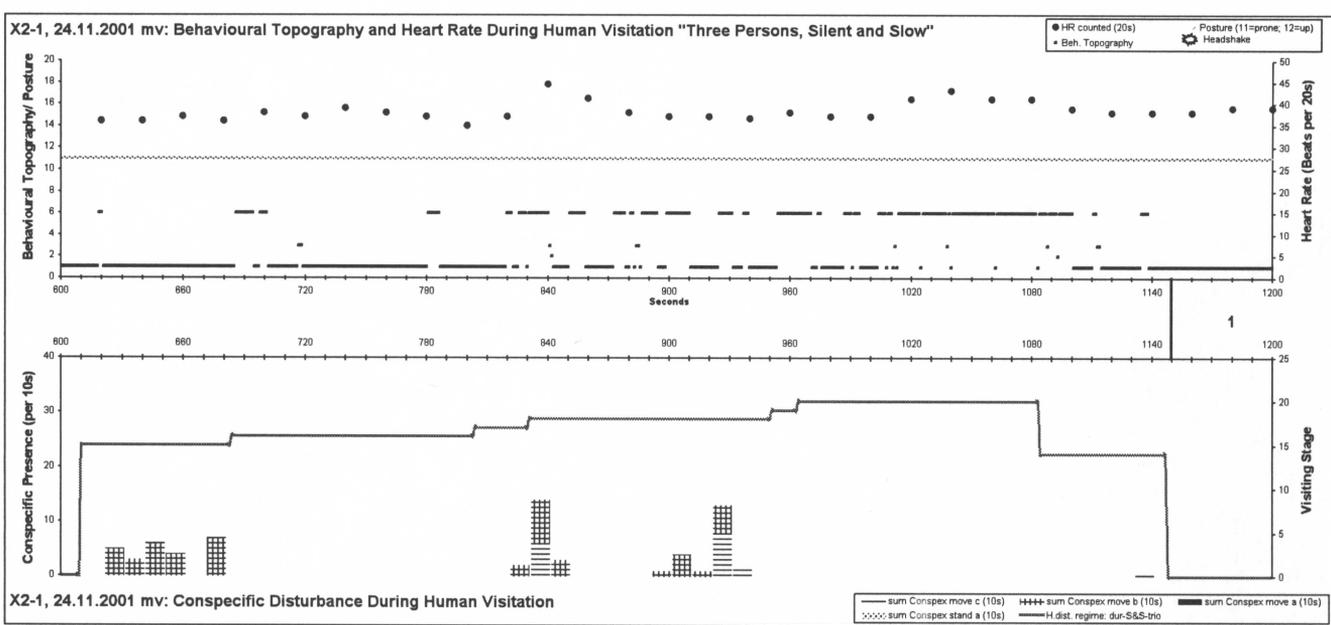
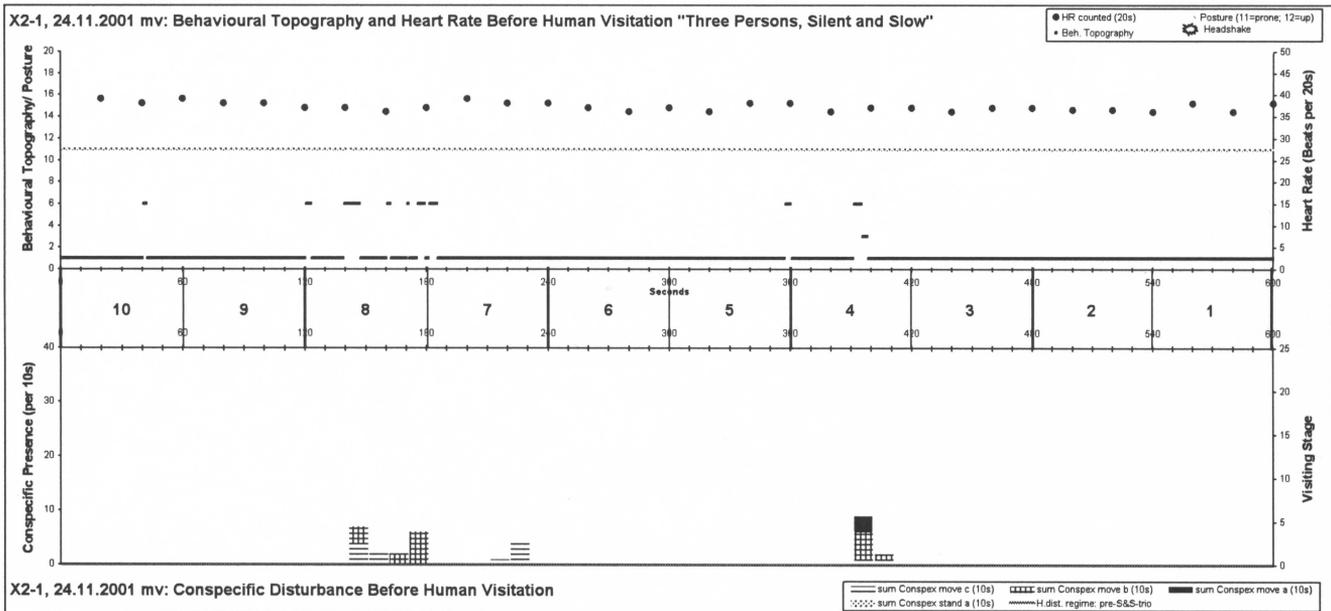


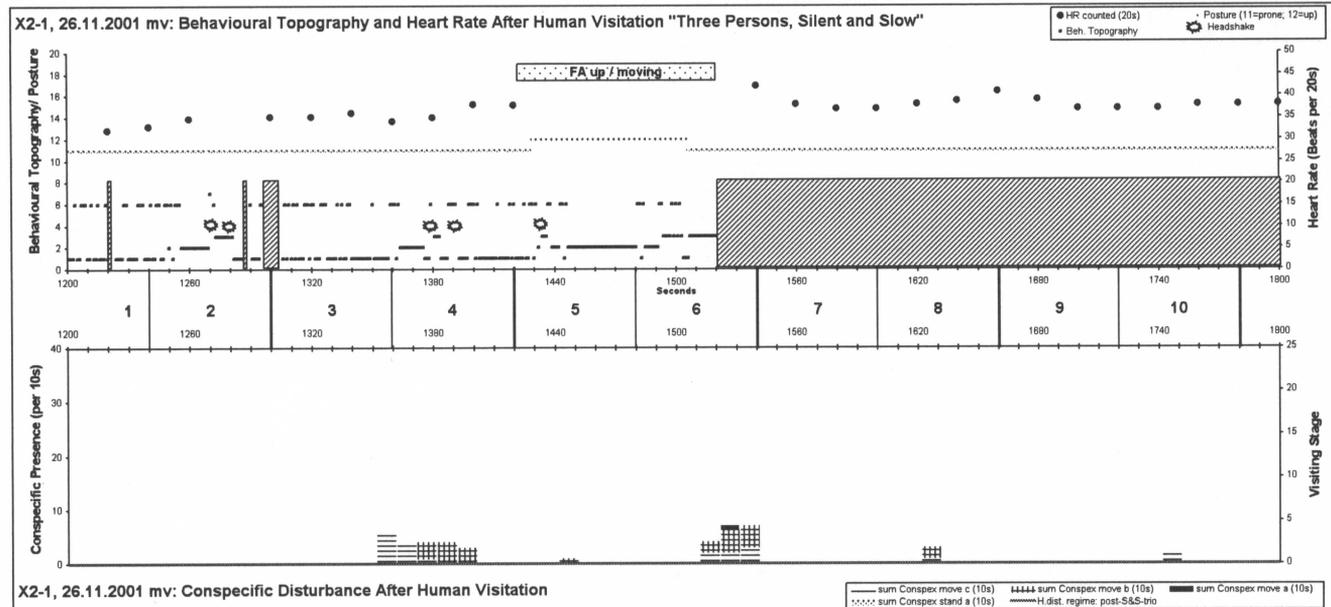
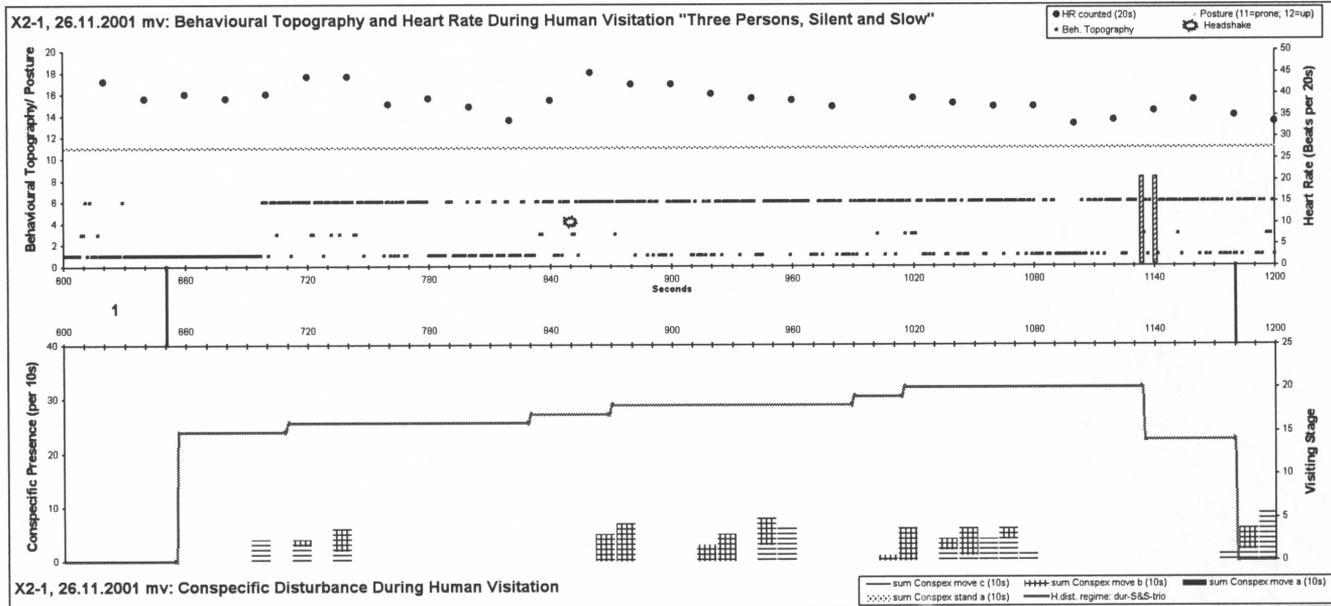
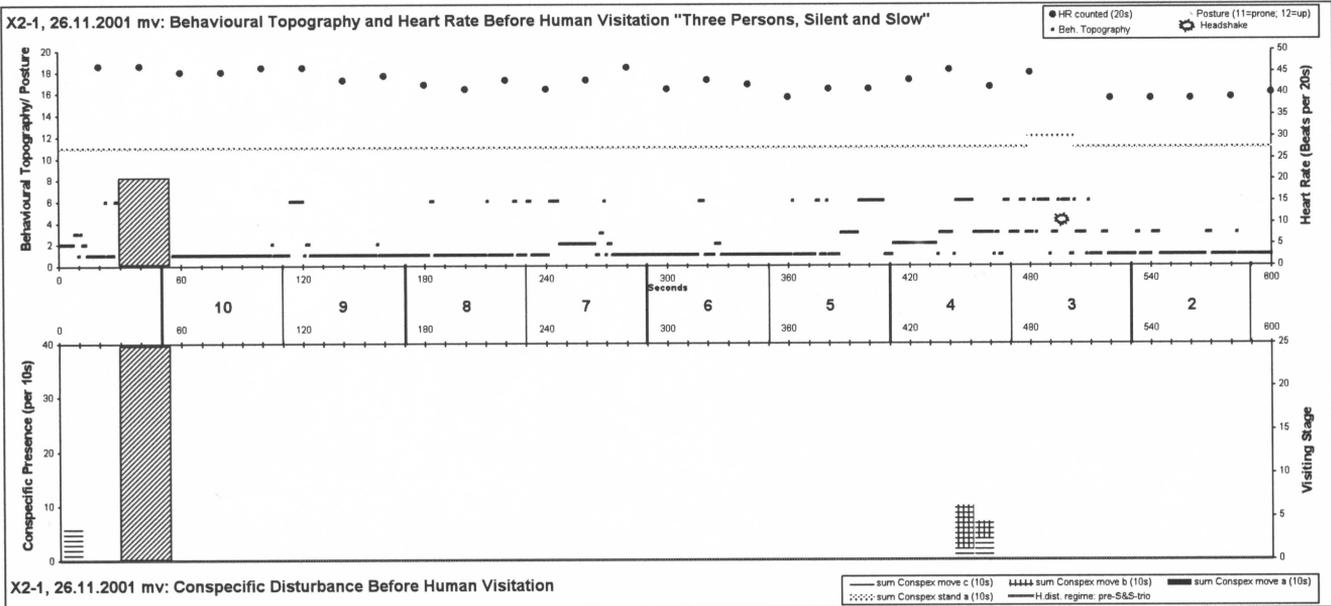
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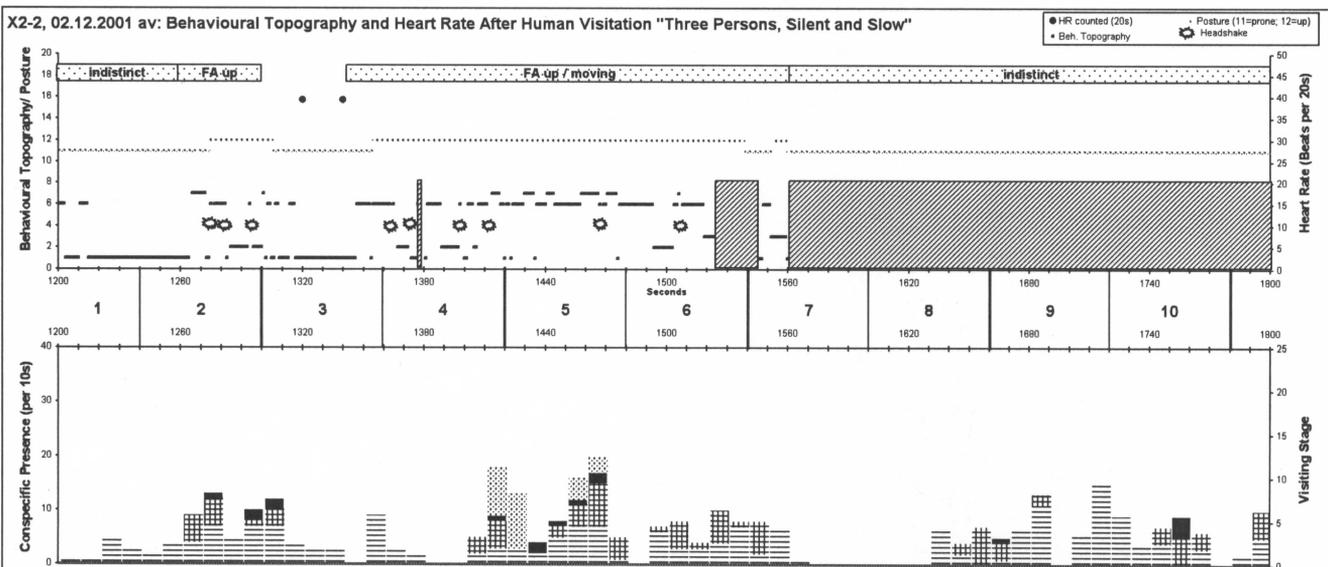
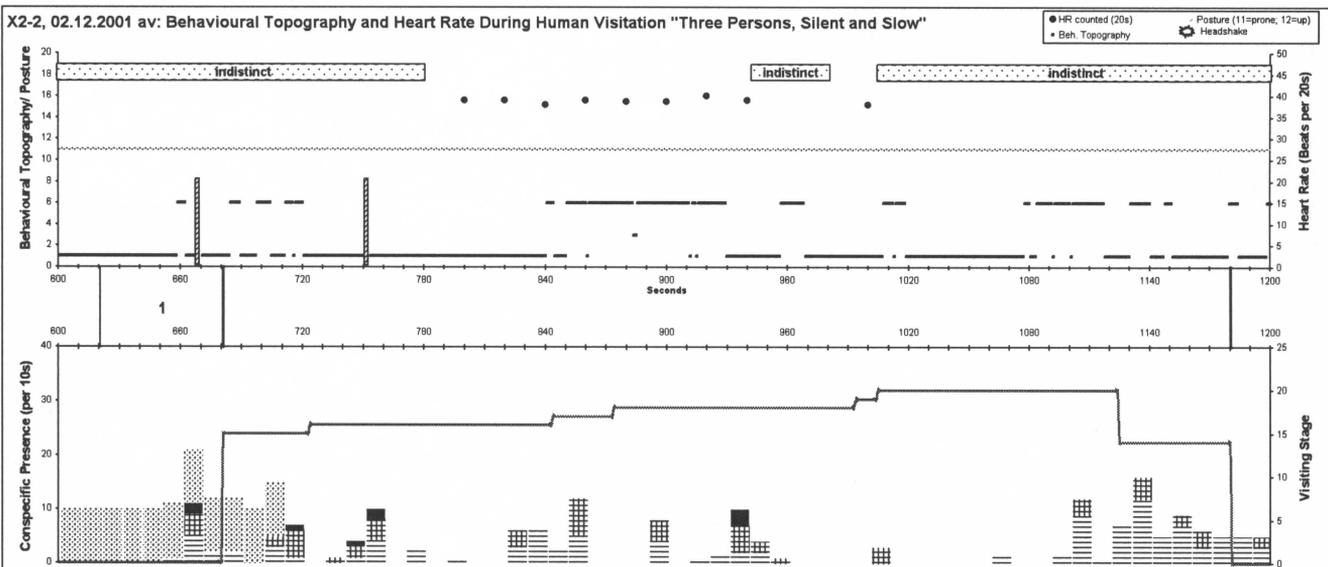
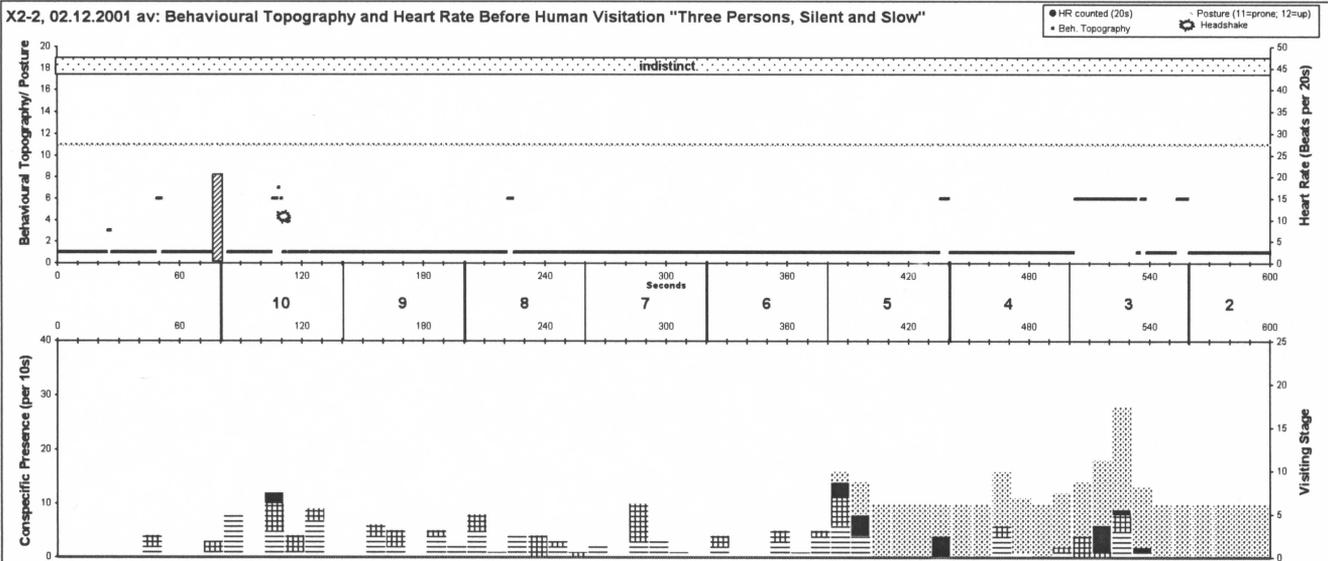


**X1-1, 26.11.2001 mv: Conspecific Disturbance After Human Visitation**

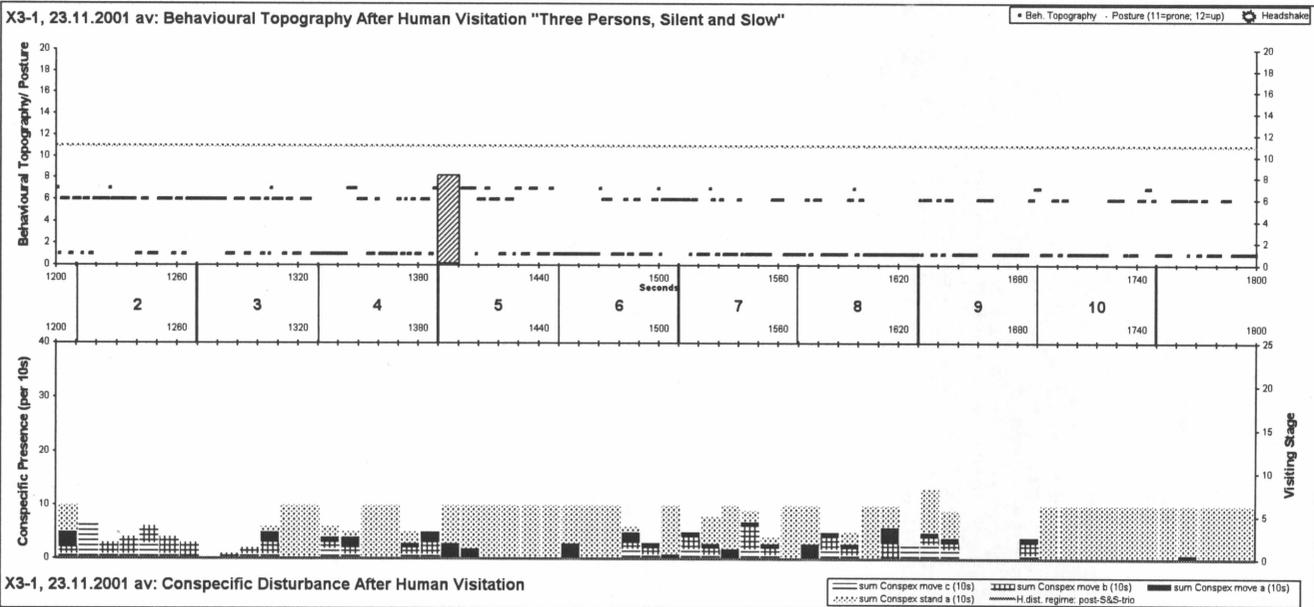
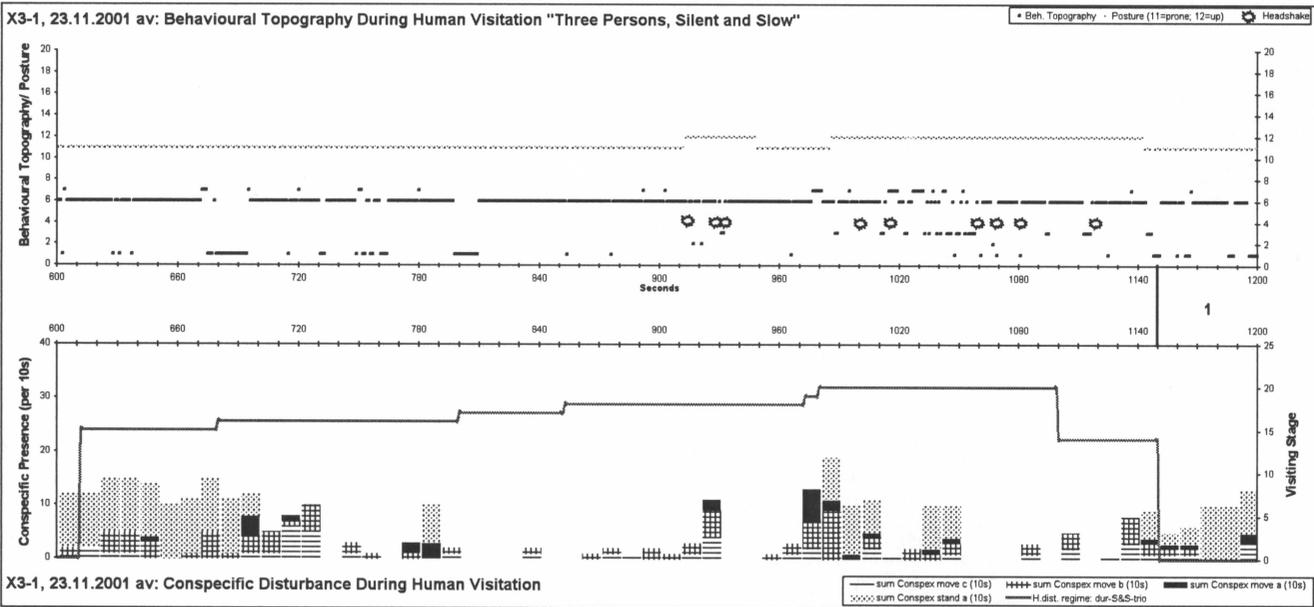
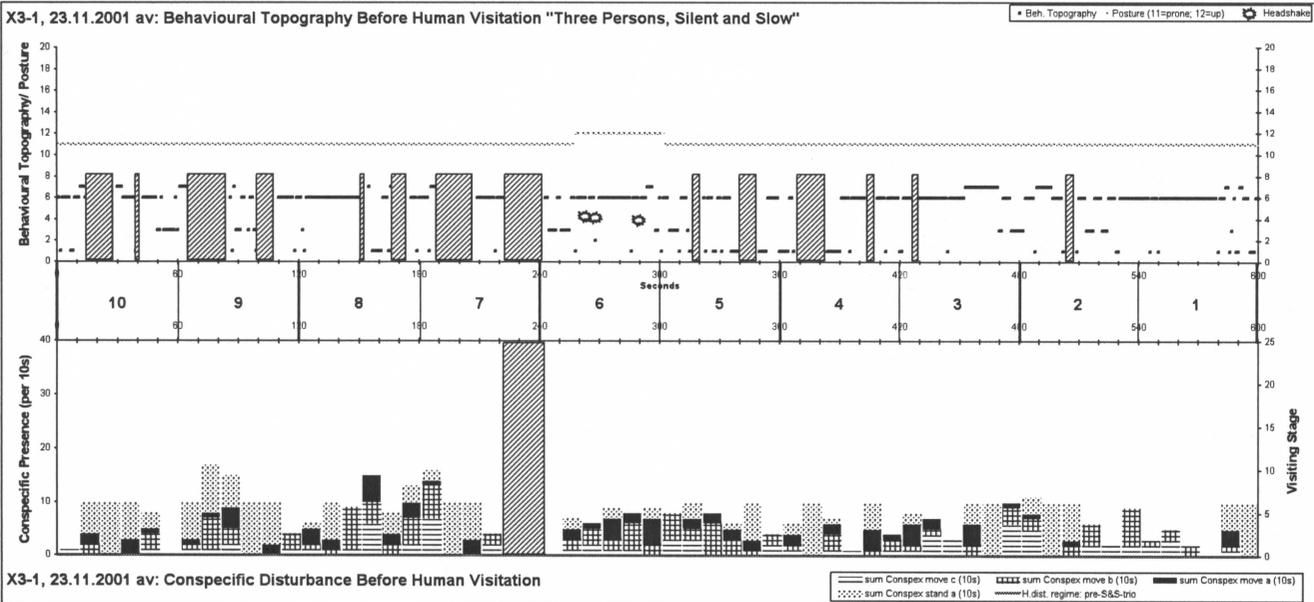


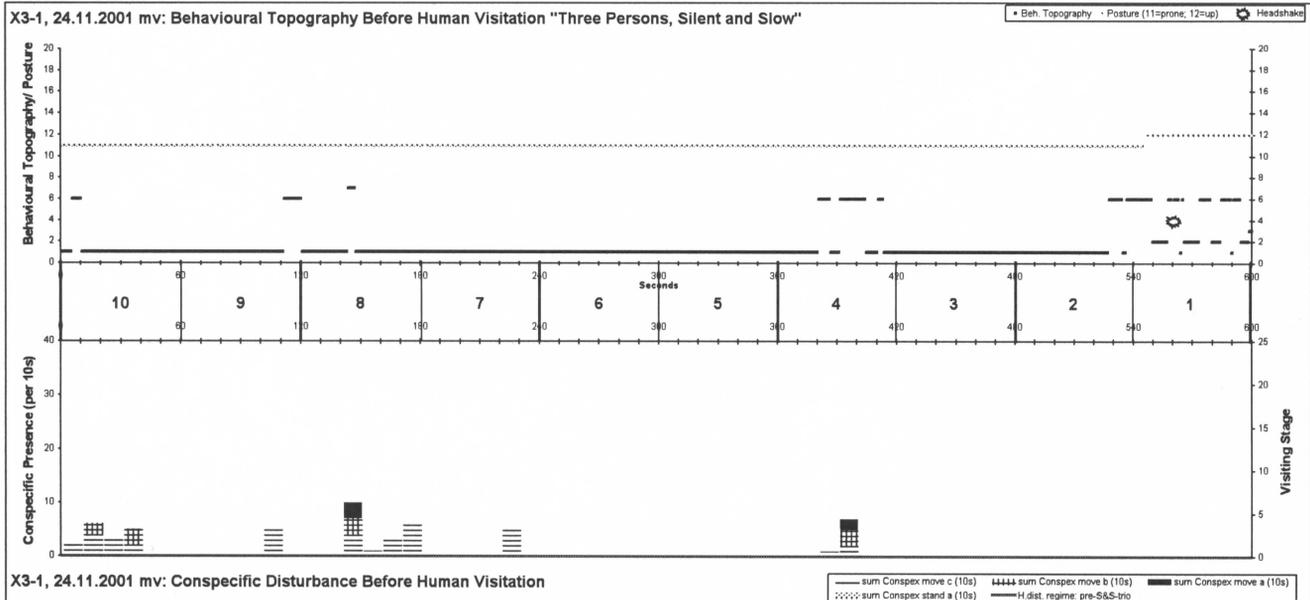




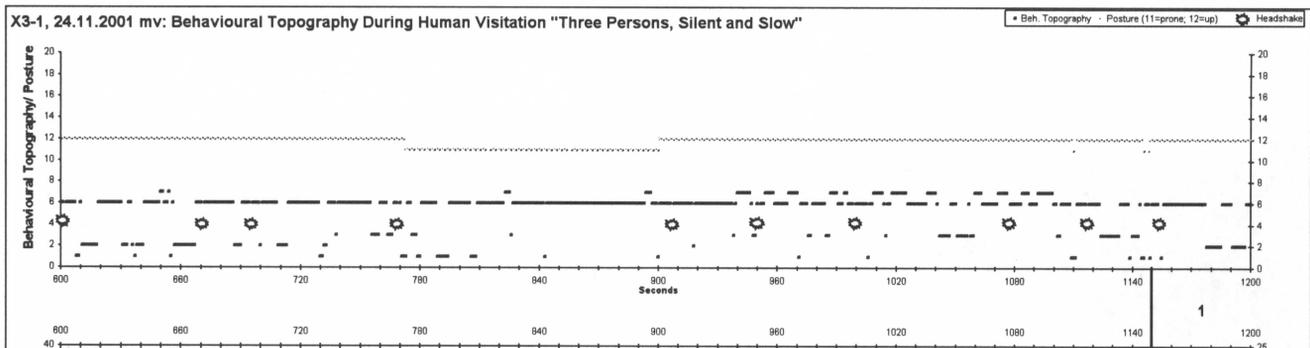


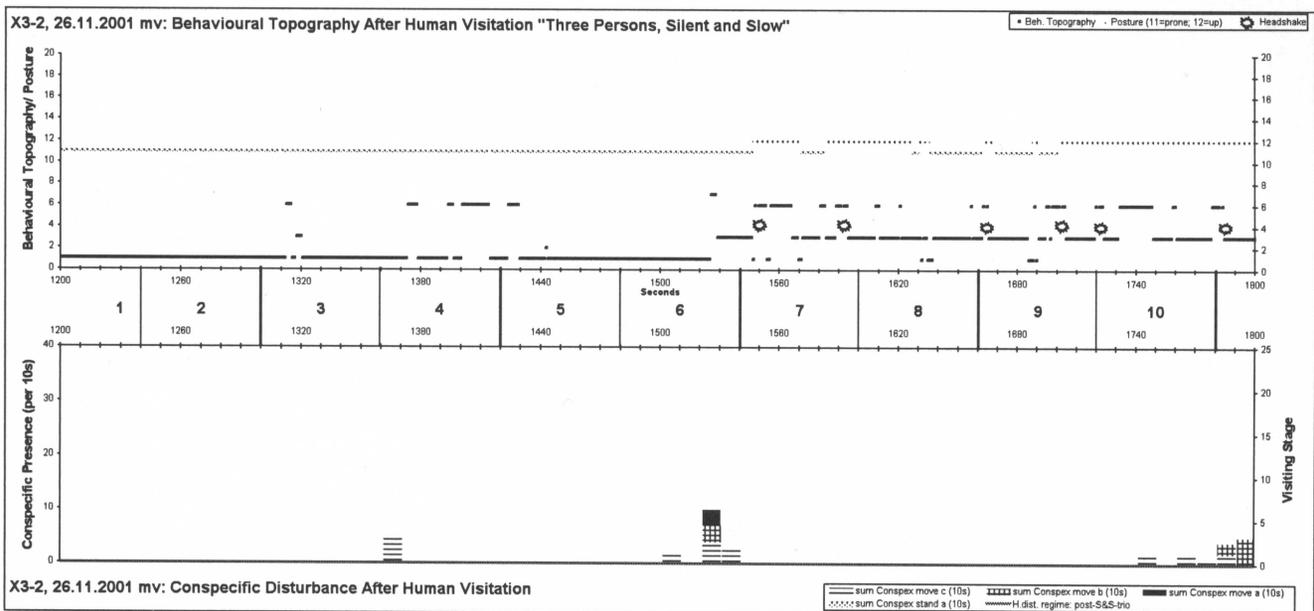
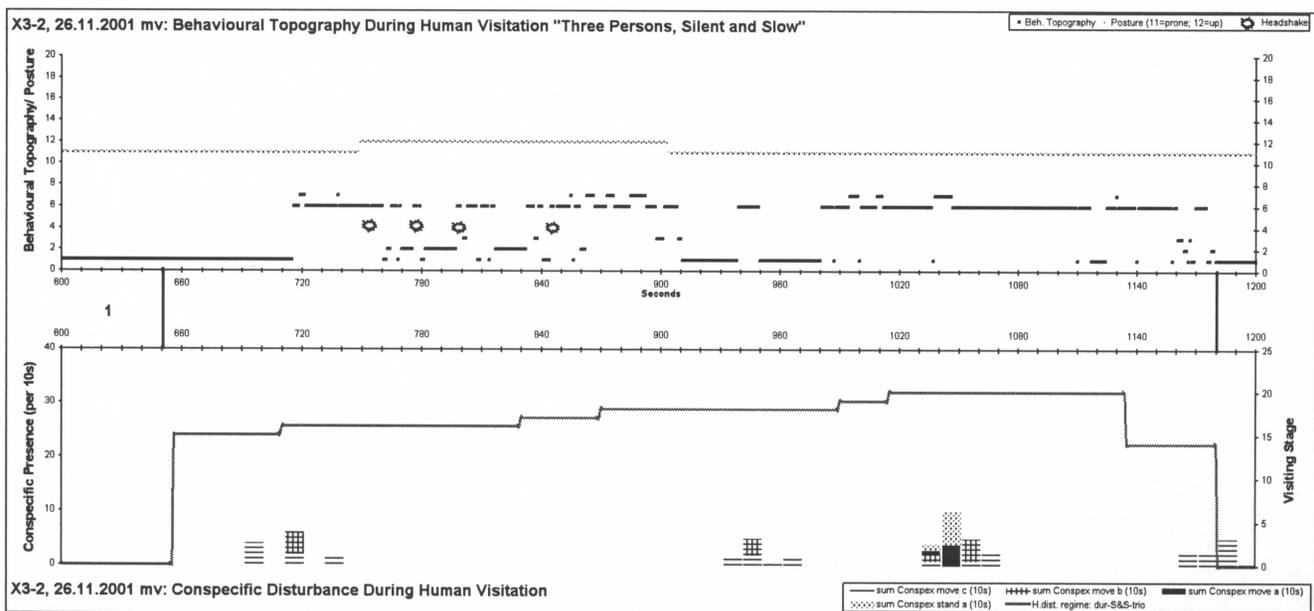
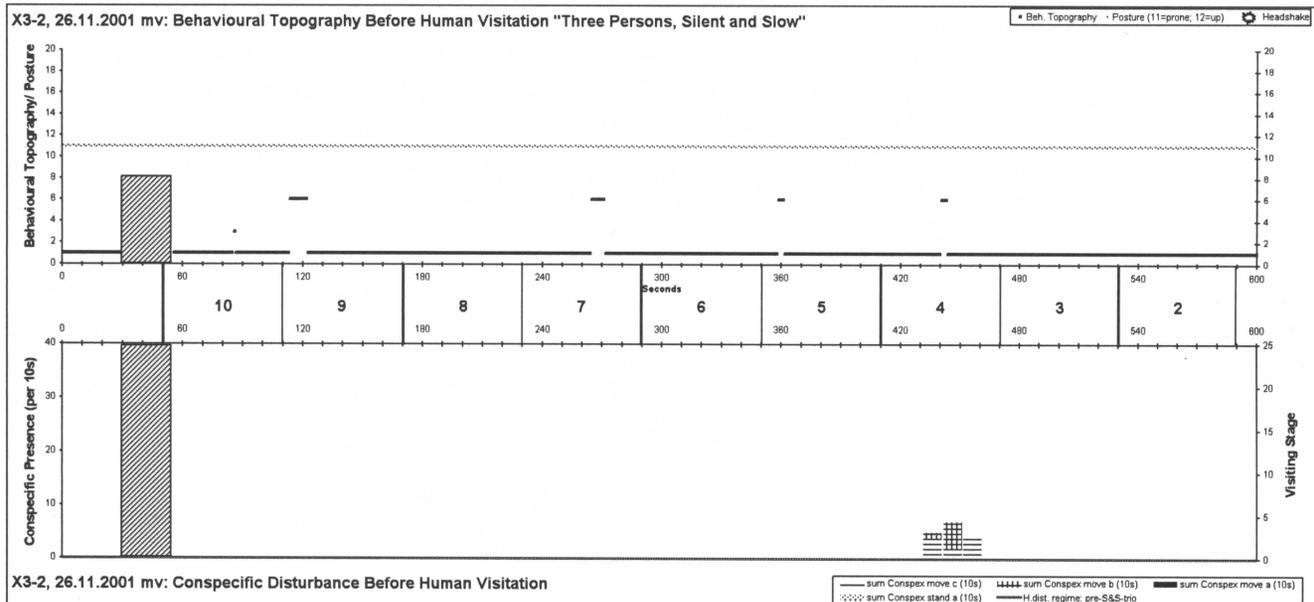
# Behavioural Topography and Conspecific Disturbance before, during and after Human Visitation



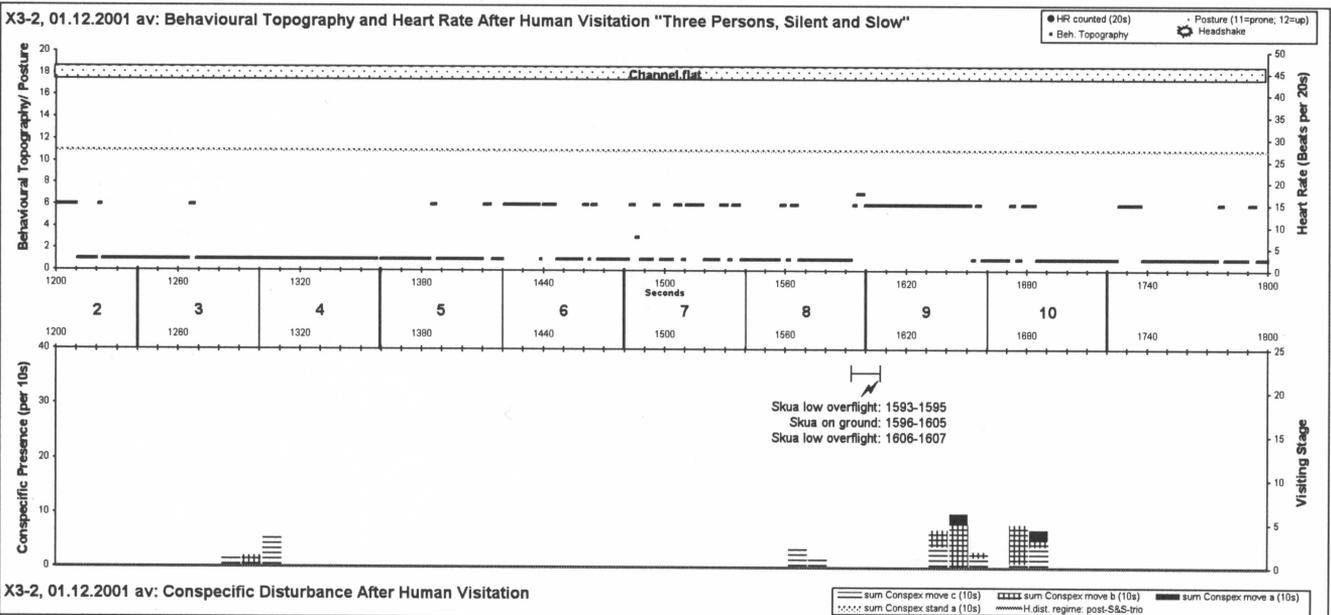
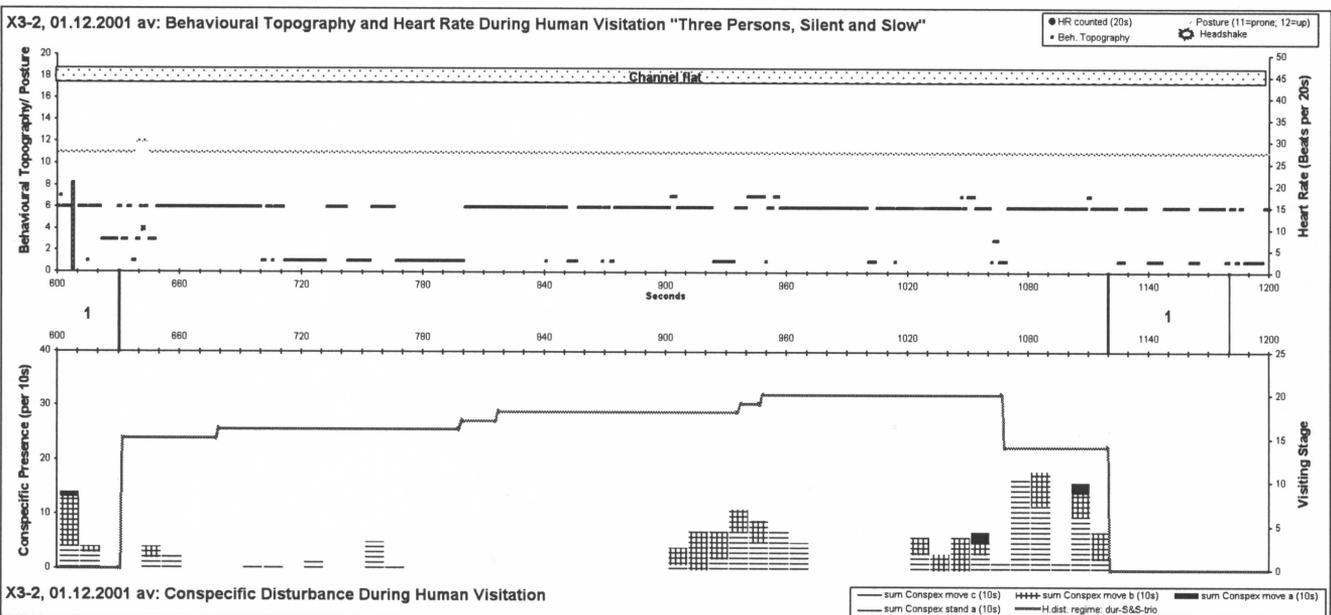
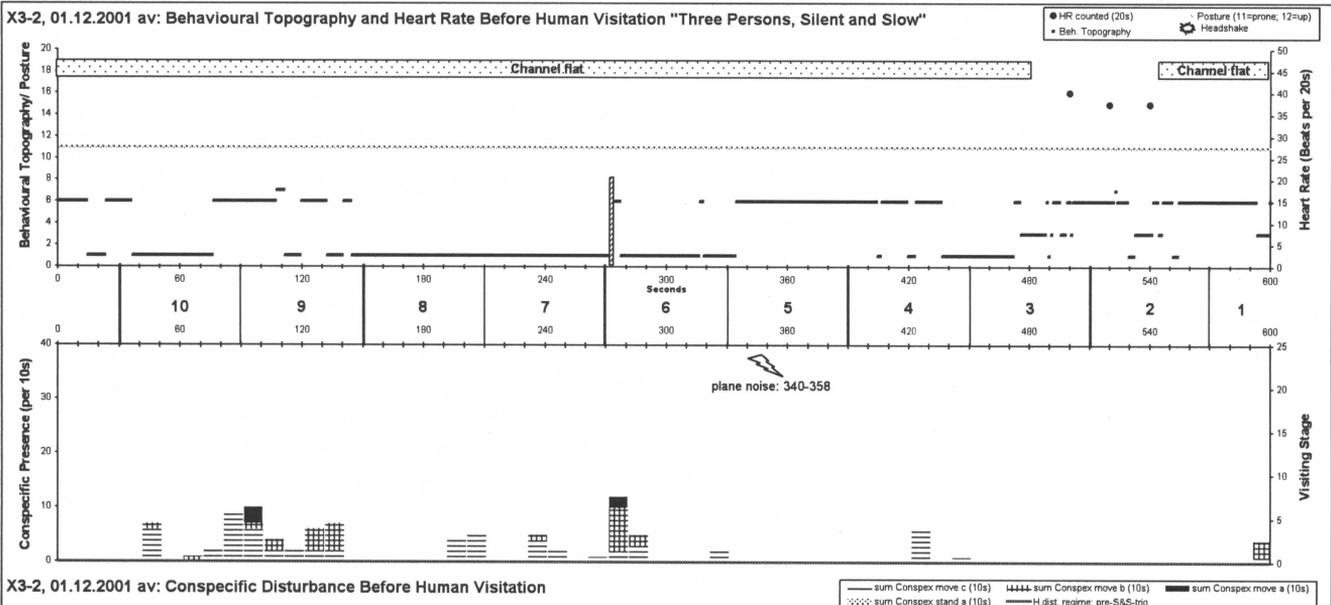


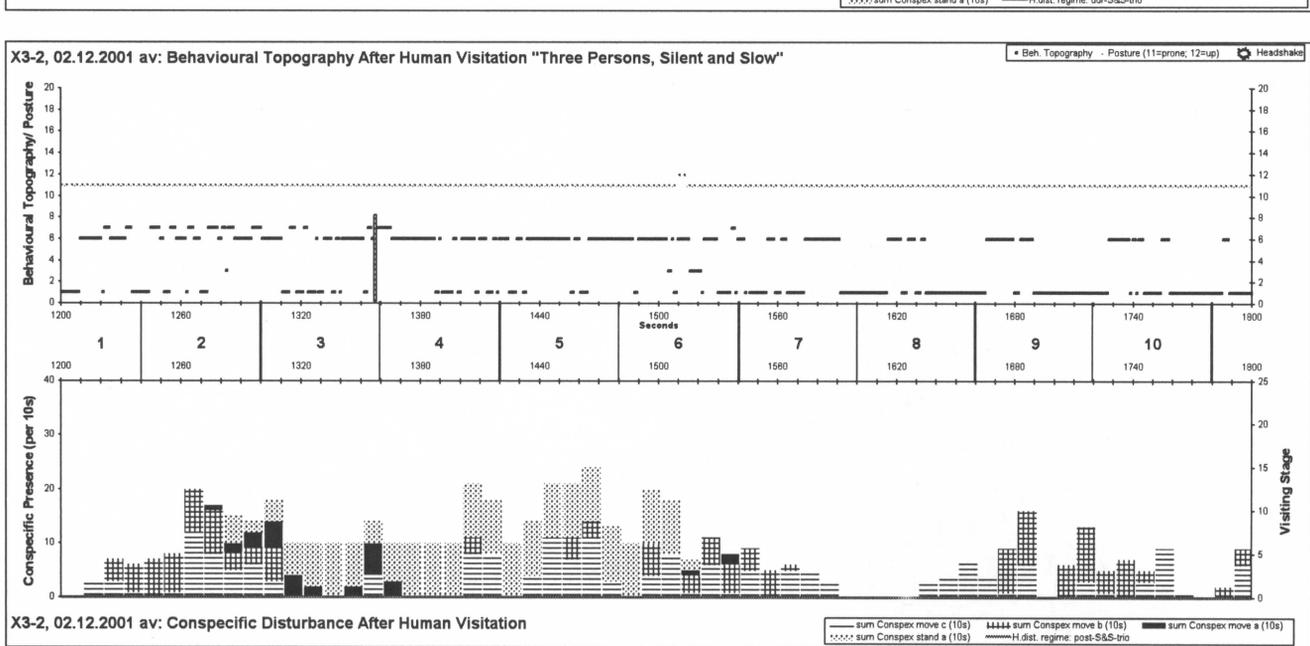
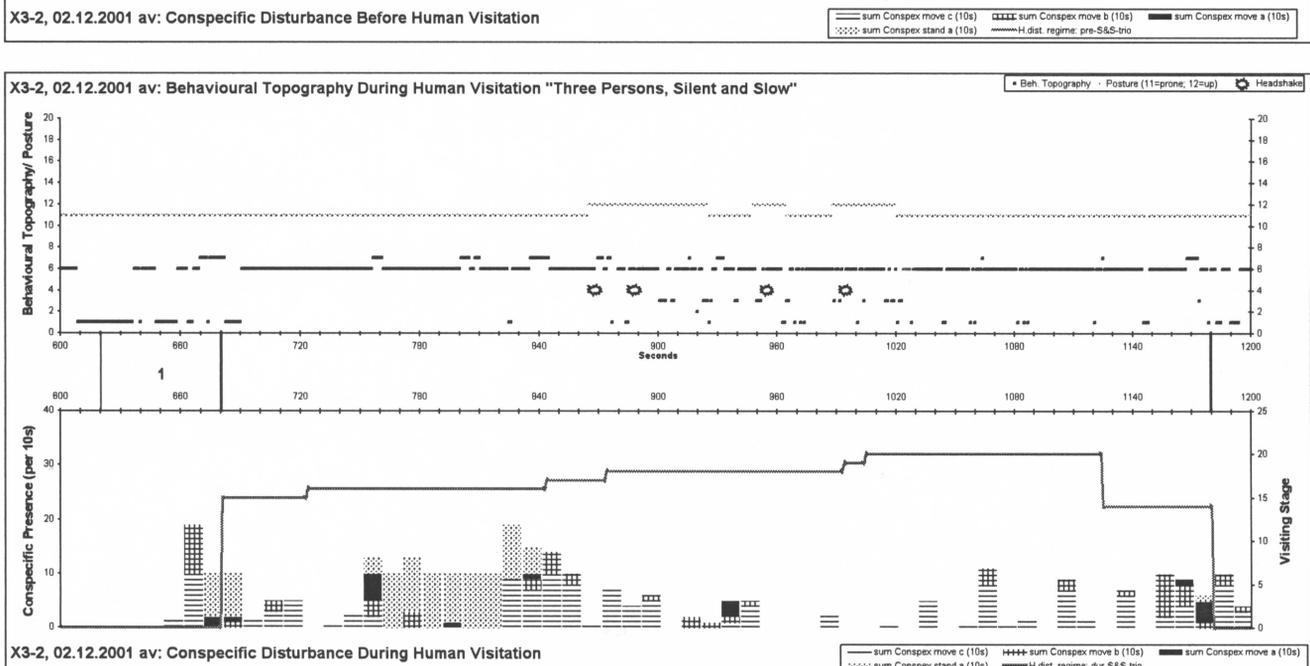
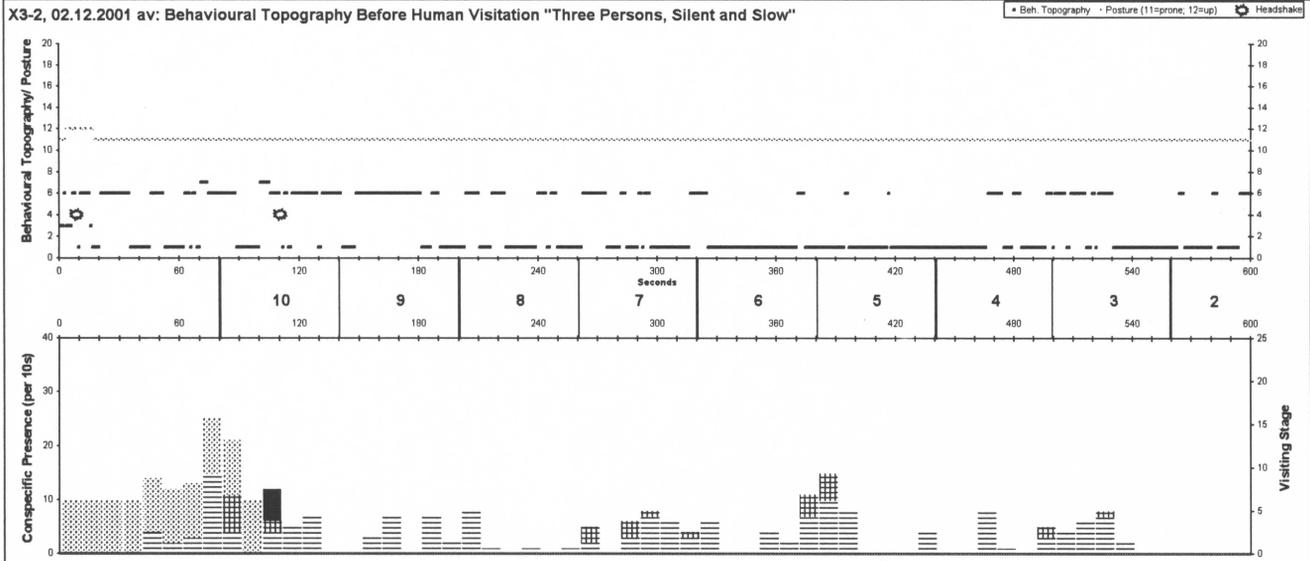
**X3-1, 24.11.2001 mv: Conspecific Disturbance Before Human Visitation**



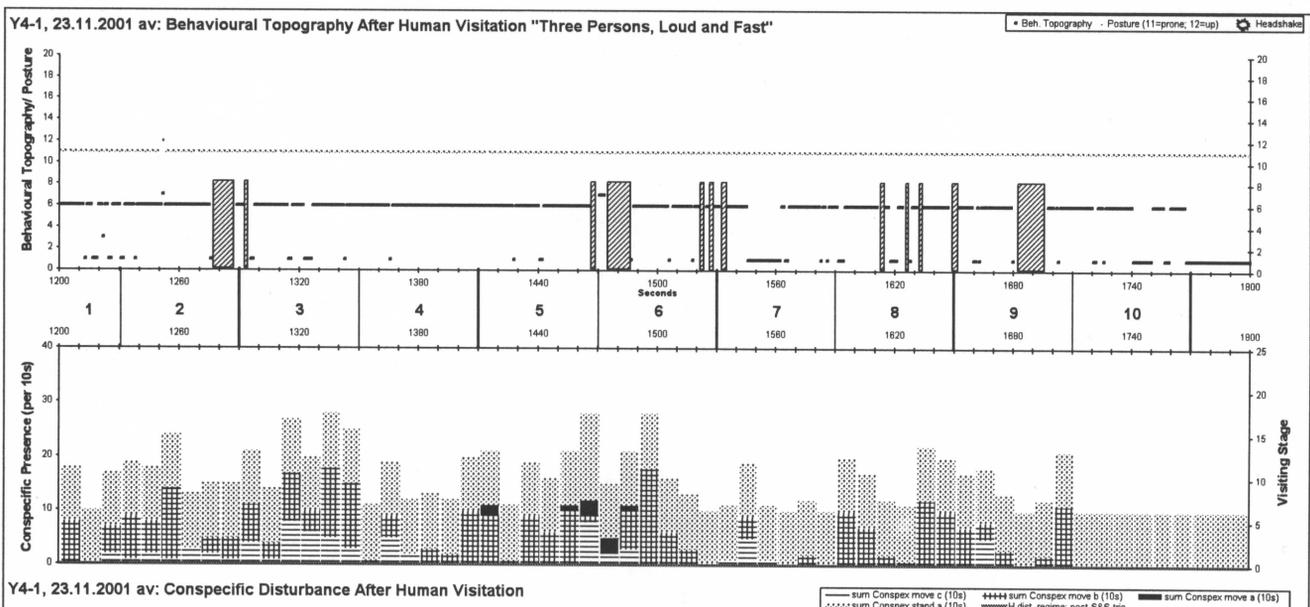
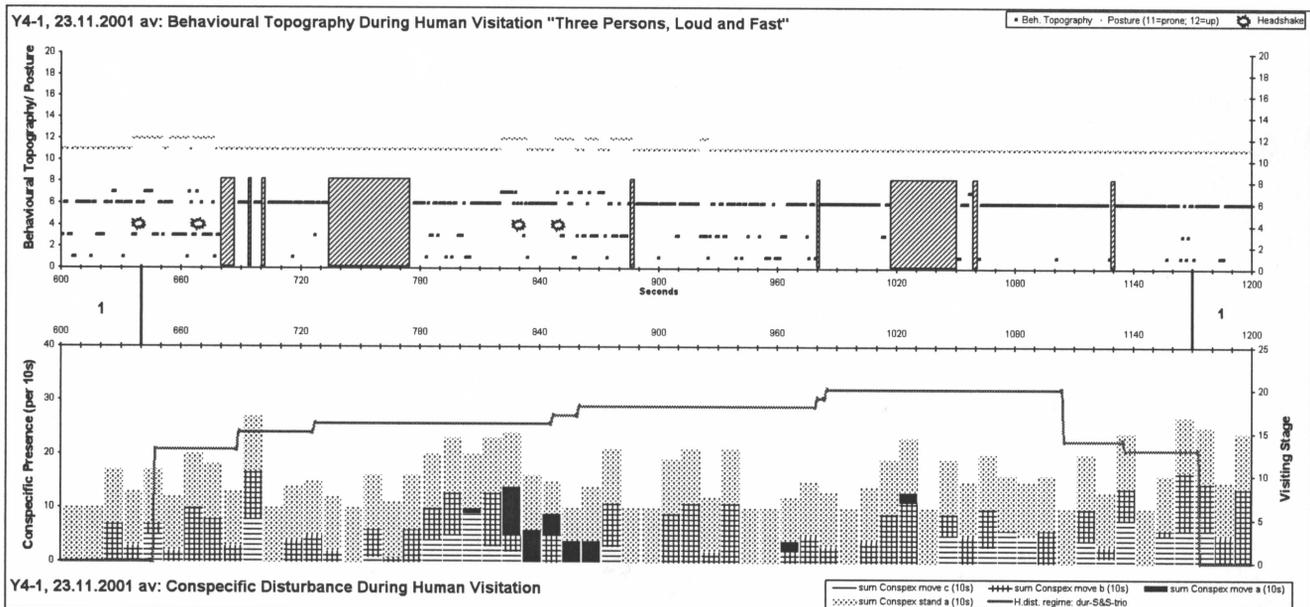
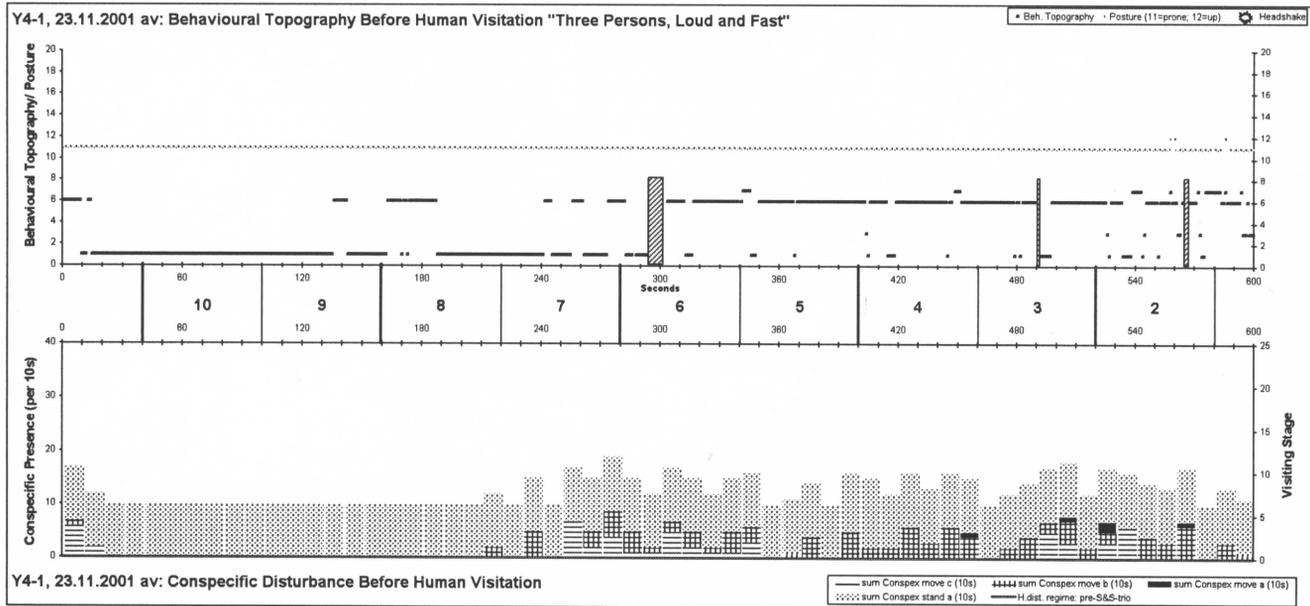


# Behavioural Topography, Heart Rate and Conspecific Disturbance before, during and after Human Visitation

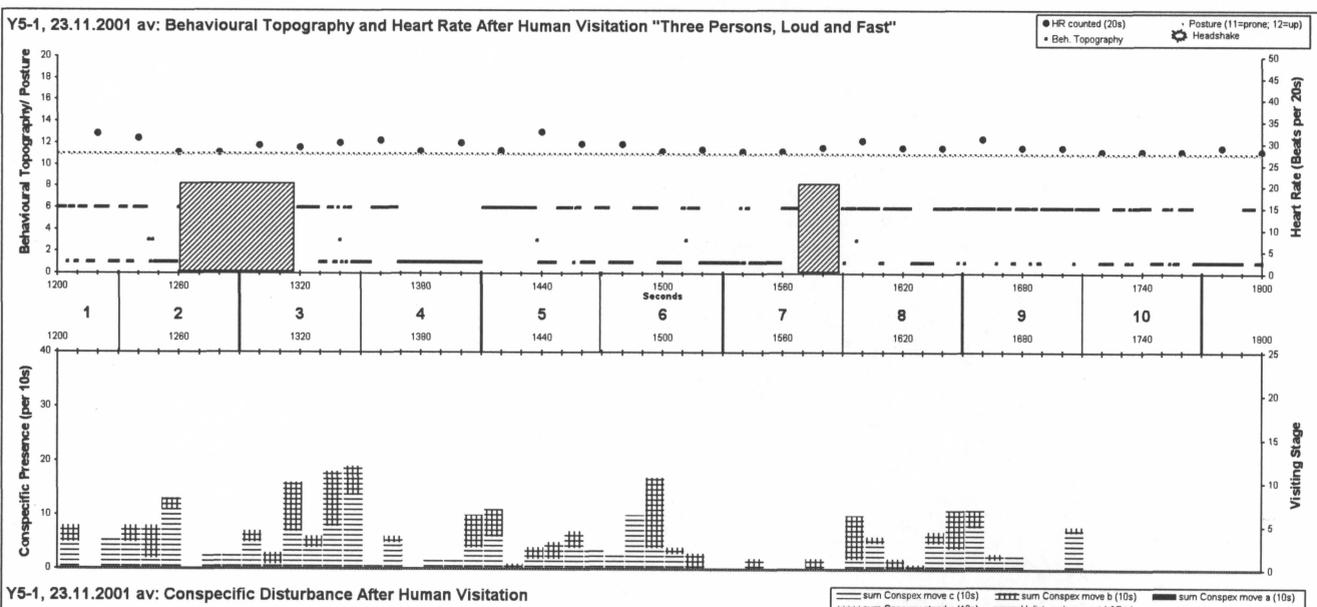
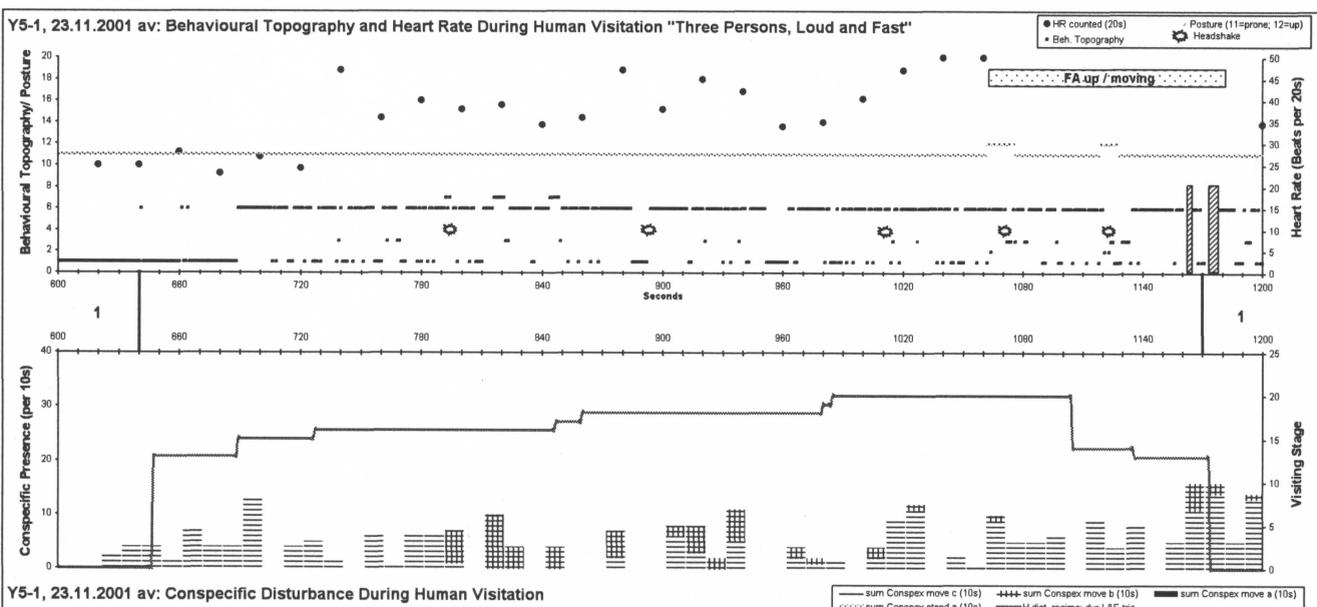
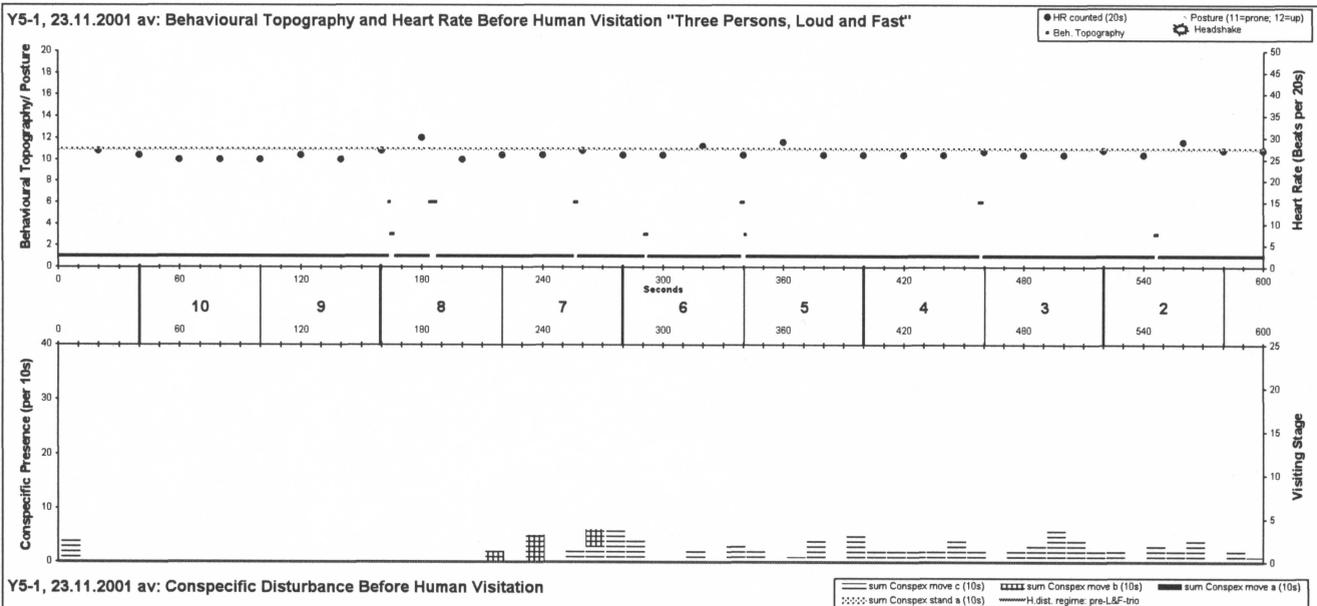


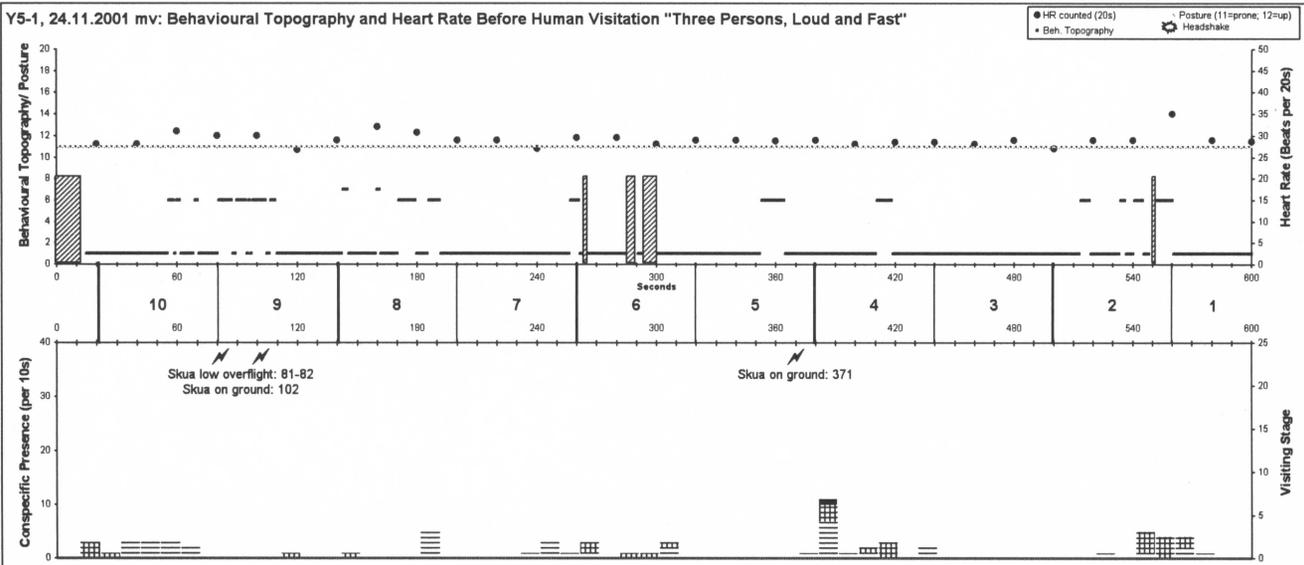


# Behavioural Topography and Conspecific Disturbance before, during and after Human Visitation

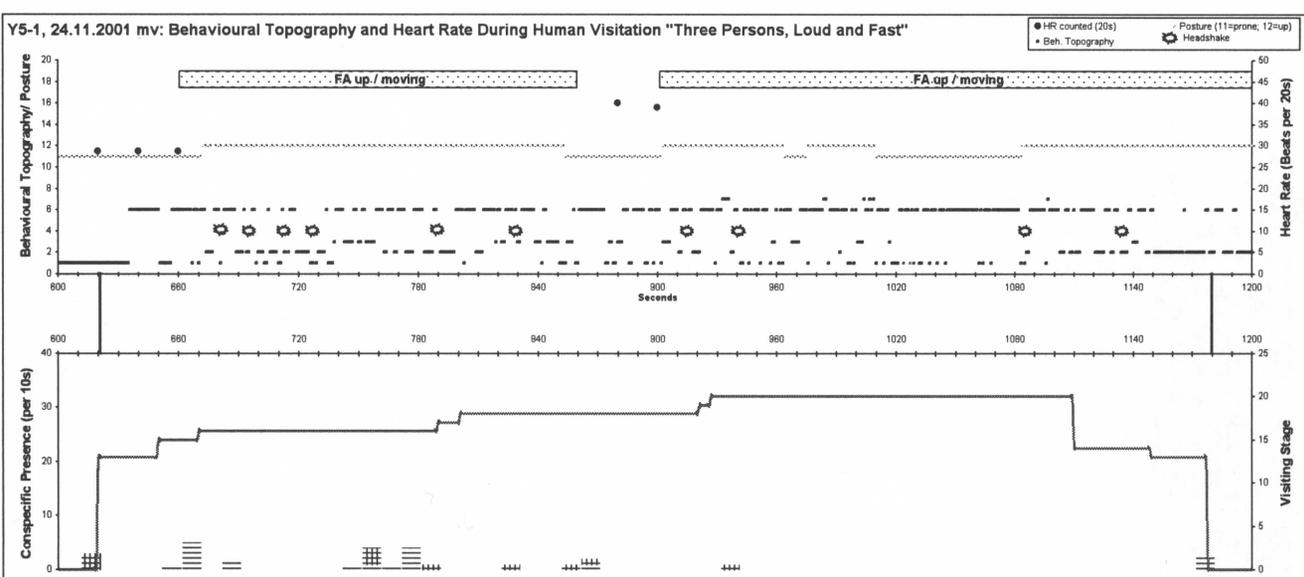


# Behavioural Topography, Heart Rate and Conspecific Disturbance before, during and after Human Visitation

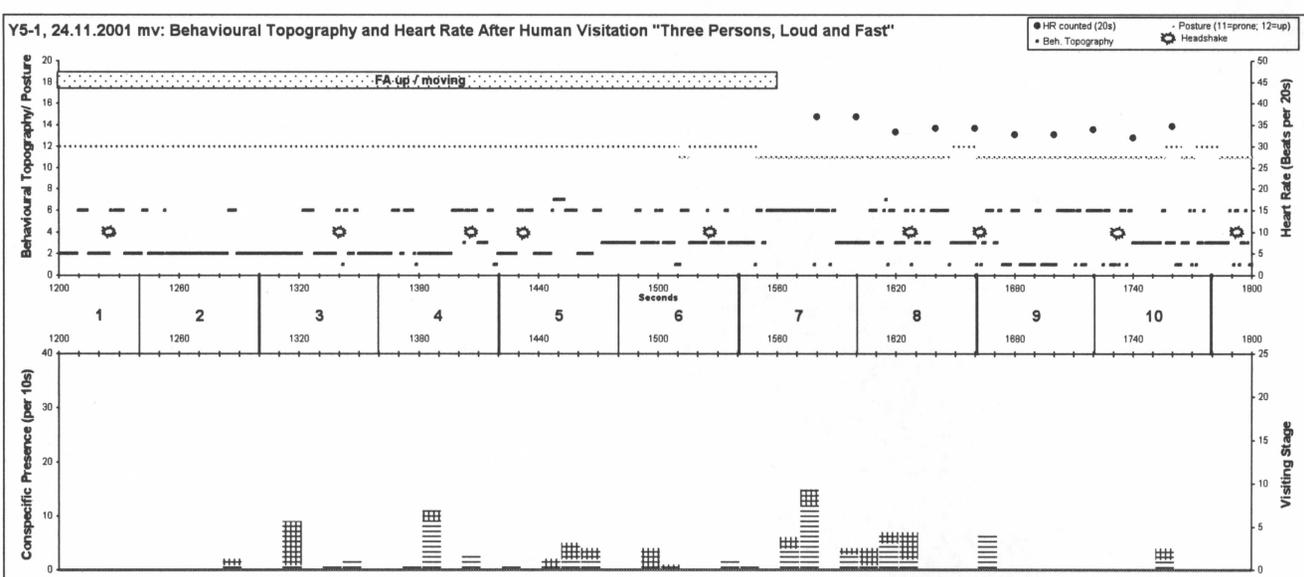




Y5-1, 24.11.2001 mv: Conspecific Disturbance Before Human Visitation

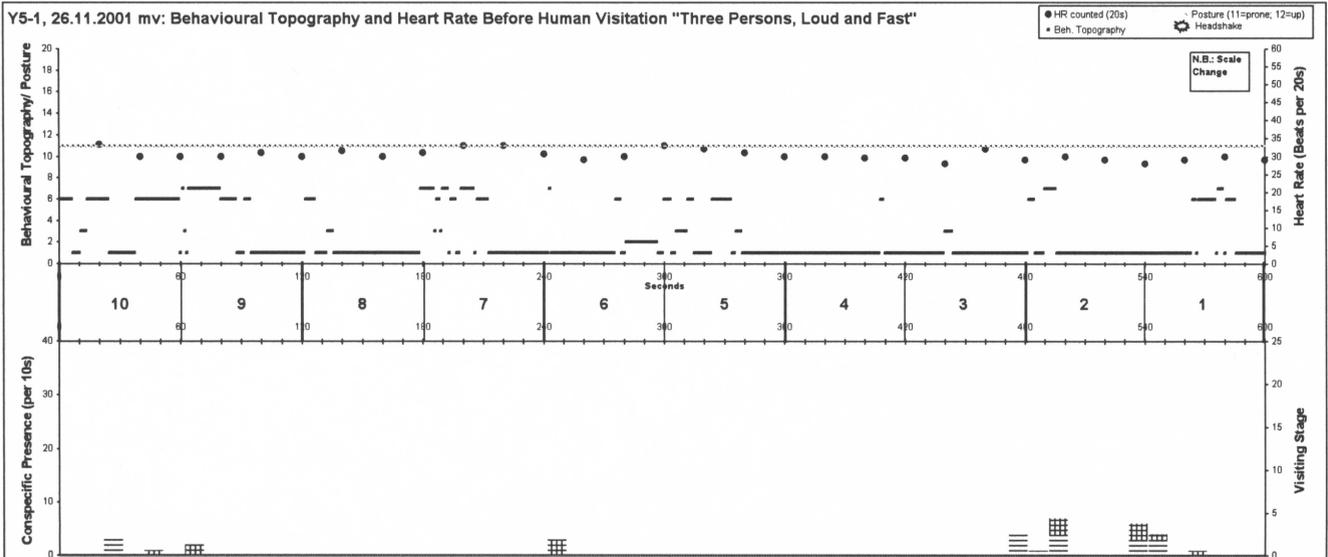


Y5-1, 24.11.2001 mv: Conspecific Disturbance During Human Visitation

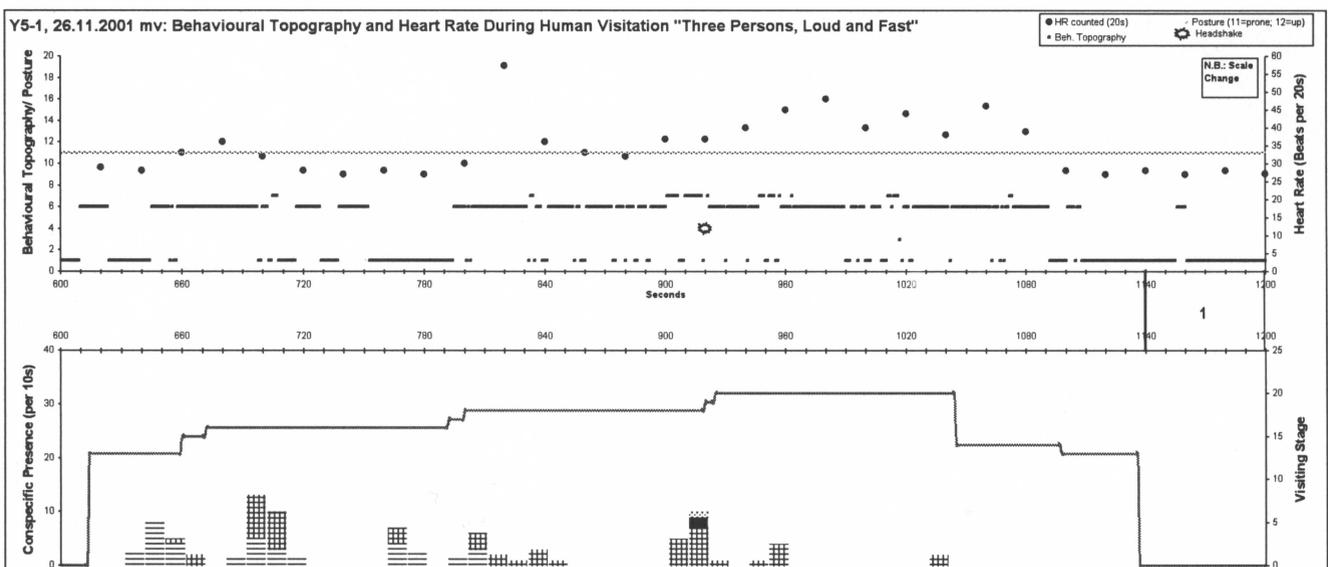


Y5-1, 24.11.2001 mv: Conspecific Disturbance After Human Visitation

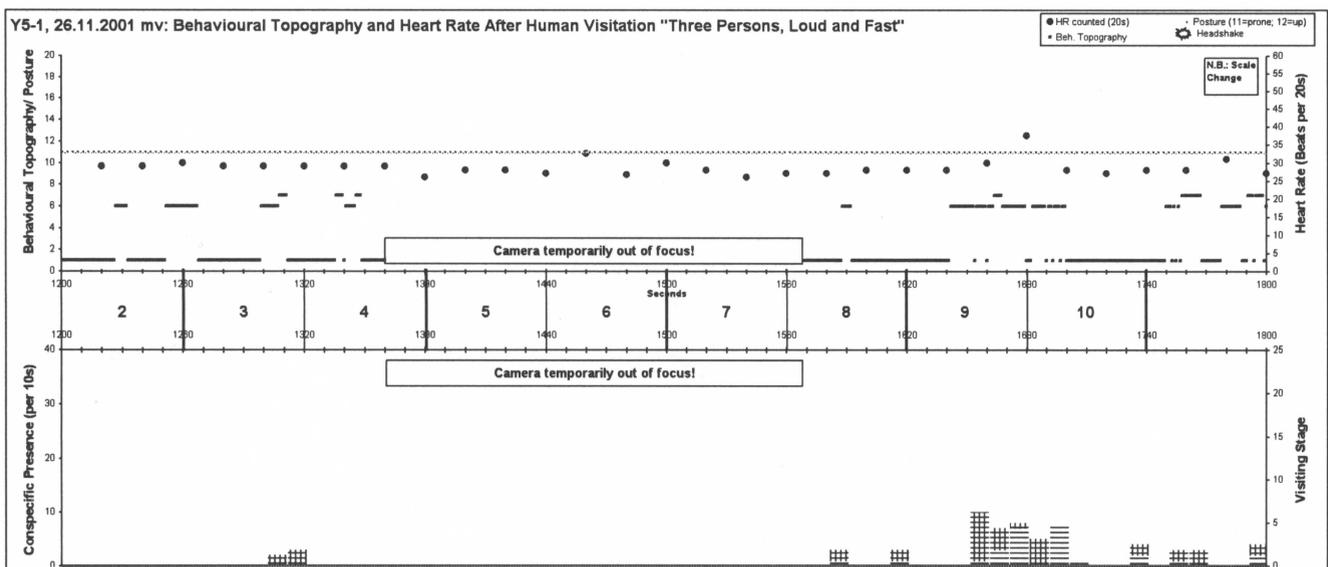
# Behavioural Topography, Heart Rate and Conspecific Disturbance before, during and after Human Visitation



**Y5-1, 26.11.2001 mv: Conspecific Disturbance Before Human Visitation**

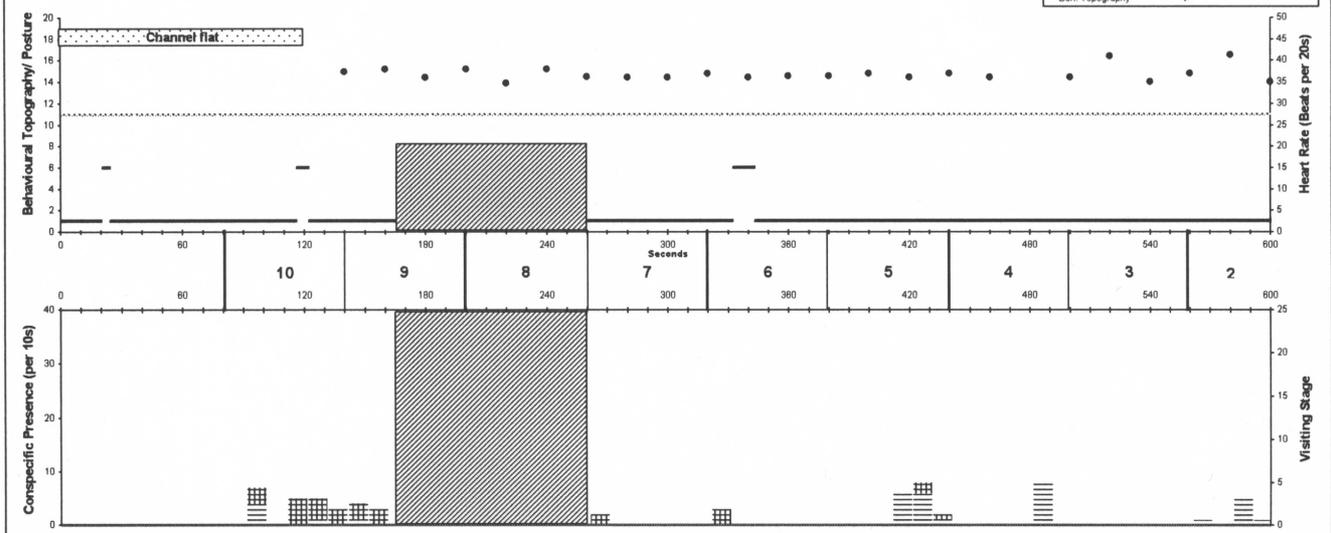


**Y5-1, 26.11.2001 mv: Conspecific Disturbance During Human Visitation**



**Y5-1, 26.11.2001 mv: Conspecific Disturbance After Human Visitation**

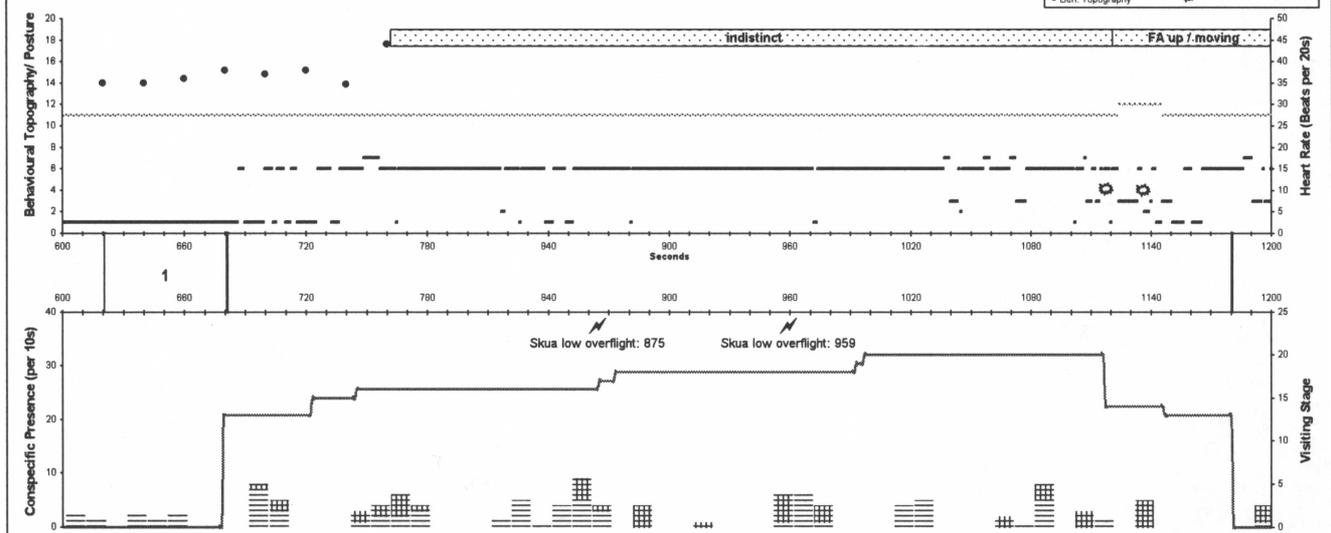
Y5-2, 01.12.2001 av: Behavioural Topography and Heart Rate Before Human Visitation "Three Persons, Loud and Fast"



Y5-2, 01.12.2001 av: Conspecific Disturbance Before Human Visitation



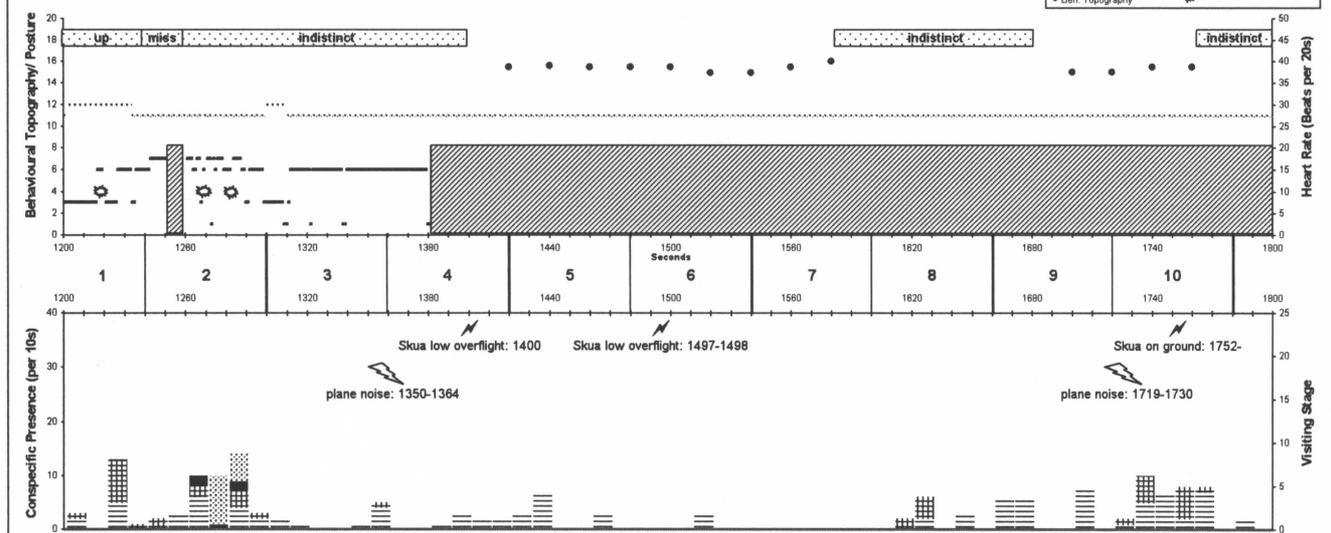
Y5-2, 01.12.2001 av: Behavioural Topography and Heart Rate During Human Visitation "Three Persons, Loud and Fast"



Y5-2, 01.12.2001 av: Conspecific Disturbance During Human Visitation



Y5-2, 01.12.2001 av: Behavioural Topography and Heart Rate After Human Visitation "Three Persons, Loud and Fast"



Y5-2, 01.12.2001 av: Conspecific Disturbance After Human Visitation



# Behavioural Topography and Conspecific Disturbance before, during and after Human Visitation

