



ASSESSMENT REPORT

Asian male elephant *Bunka*

Yerevan Zoo, Armenia

November 2022

TABLE OF CONTENTS

TABLE OF CONTENTS	2
1. Introduction	4
2. Aim	5
3. Methods	5
4. Physical & Environmental Assessment	6
4.1 Elephant Health: Visible Body Condition	6
General elephant body condition	6
Elephant foot condition	7
4.2 Elephant Nutrition	9
4.3 Elephant Behaviour	11
4.4 Elephant Infrastructure	12
4.5 Elephant Management	18
4.6 Physical and Environmental discussion points	20
Health	20
Nutrition	20
Infrastructure	21
Management & Husbandry	21
5. Assessment of Behaviour and Psychological State of Bunka	23
5.1 Introduction	23
Elephants	23
Diseases	24
5.2 Methods	25
5.2.1 Actogram	25
5.2.2 Space use	25
5.2.3 Detailed behaviours	25
5.2.3.1 General Activities: (in addition to above in the actogram)	25
5.2.3.2 Detailed short behaviours	26
5.3 Data analyses	27
5.3.1 General daily activities	27
5.3.2 Space use	27
5.3.3 Detailed behaviours	27
5.4. Results	28

5.4.1 General Activities	28
5.4.1.1 Actogram	28
5.4.1.2 Space Use	28
5.4.2 Detailed Behaviours	29
Categories	30
5.4.2.1 Boredom Related Behaviour	30
5.4.2.2 Stereotyping Behaviour	31
5.4.2.3 Ambivalent Behaviour	32
5.5 Discussion of Behaviour	34
5.5.1 Activity	34
5.5.2 Space Use	35
5.5.3 Detailed Behaviours	36
5.5.4 Solitary keeping	36
5.5.5 Stereotypies	36
6. Future considerations	38
7. Summary	40
Appendix I	43
Details of behaviours of Bunka noted from videos	43
Appendix II	45
Arguments often brought up why elephants should be kept in zoos	45
Appendix III	48
Selected statements from various zoo guidelines	48
EAZA Standards for the Accommodation and Care of animals in Zoo and Aquaria 2014	48
WAZA Code of Ethics and Animal Welfare 2003	49
AZA Standards for Elephant Management and Care 2012	49
BIAZA Management Guidelines for the Welfare of Zoo Animals - Elephants	50
Citations	51

1. Introduction

Topic	Elephant assessment (<i>Elephas maximus</i>)
Name of animal	Bunka; born on 30 th December 2007 in Tbilisi Zoo, Georgia, Caucasus
Date of assessment	November 29-30, 2022
Location	Yerevan Zoo, Yerevan, Armenia, Caucasus
Weather condition	29 th : 1°C – 13°C (dry) 30 th : 1°C – 8°C (rainy/drizzly)
Completed by	Ingo Schmidinger on behalf of <i>Friends of Bunka</i> Dr. Marion Garaï - Elephant Reintegration Trust Tenisha Roos - Elephant Reintegration Trust Brett Mitchell - Elephant Reintegration Trust

Elephant background: *Bunka* is an Asian male elephant, born in Tbilisi Zoo, Georgia, on December 30, 2007. Mother: Malka (born 1997 in Laos – 2000 to Tbilisi). Father: Bacho († 2008 of pneumonia). Bunka was exchanged with Grand and arrived at the city zoo on July 9, 2014, aged 6.5 yr. Now at the age of 15 years, he is still living solitary (only elephant in Armenia). Bunka is registered as “city property”, like other animals at the zoo, as this institution is managed by the Yerevan municipality.

2. Aim

The aim of this report is to present an in-depth assessment of the overall physical (visible body condition) and psychological wellbeing of Bunka, established through carrying out a series of visual observations on the ground and to determine his current living conditions and wellbeing.

3. Methods

The assessment focuses on observations and data collected during a site visit, and includes information provided by the responsible persons (zoo administration and caretakers):

- Observation of visible elephant body condition and getting to understand the elephant's health aspects
- Inspection of the elephant's enclosure infrastructure (inside barn and outside enclosure)
- Observation of the current elephant husbandry management and daily working routine
- Observation and recording of elephant behaviour: psychological aspects observed during the assessment (See Section 5. Assessment of Behaviour and Psychological State of Bunka)

The inspection and specific observations are based on the "Five Domains Model"¹, a tool for guiding systematic and thorough assessments of animal welfare states. It focuses on identifying the animals' internal and external conditions that give rise to mental experiences, namely: the quality of its nutrition, the physical environment it lives in, its health status, and its behavioural interactions within the physical and social context.

The sum of all mental experiences (physical and psychological aspects) represents the wellbeing status of an animal at a given time. Therefore, the required information is collected through a species-specific questionnaire, as well as through direct observation and further detailed analysis of data collected on site. This provides the basis for target-oriented solutions to ensure Bunka's wellbeing and to meet his essential needs.

This report is based on observations made by the inspection team and discussions held with zoo staff during the visit on 29th and 30th of November 2022. It represents a snapshot of actual conditions and circumstances. It relies on verbal answers provided by Bunka's caretakers and responsible persons to obtain information on further husbandry aspects that could not be evaluated directly. The Behavioural Assessment has considered videos taken during the visit and independent observations.

4. Physical & Environmental Assessment

4.1 Elephant Health: Visible Body Condition

General elephant body condition

Taking into consideration Bunka's height, growth stage and age (15yrs) he is underweight with clear signs of gauntness and being undernourished. According to the Asian Elephant Body Condition Index², his shape ranks at index 2. Note: (1) highly underweight, (5) highly overweight. Description of index 2:

- i. Ribs: Some ribs may be noticeable; ribs appear to be covered by a very thin fat layer.
- ii. Pelvic bone: Clearly visible; obvious depression in front and/or behind pelvic bone.
- iii. Backbone: Prominent from tail head to shoulders; obvious depression alongside entire backbone.



Figs 1&2 – Body condition

He shows an abnormality regarding the head: body ratio. Relative to his thorax/abdomen size, his head appears small, which is not uncommon in elephants kept under similar conditions. This aspect is accompanied by a generally weakish body posture and an inferior muscular condition.

It was reported that he was last in *musth* during June/July 2022. His first *musth* period was noted in June 2019, lasting for 1 month and similarly in 2020 and 2021.

Elephant foot condition

Nail #5 of Bunka's left forefoot is entirely cracked (from distal to proximal in the middle of the nail) and shows an already developed abscess in the middle of the crack. Nail #4 of Bunka's right hindfoot shows a deep crack halfway from distal to proximal. Both hindfeet show an extremely smooth and thin layer of skin of the sole with no visible profile of pad (overwear). There is a lack of interdigital space between nails #2-4 of both forefeet, where adjacent nails are nearly rubbing each other. Generally, cuticles appear slightly overgrown.



Fig. 3 – Crack and abscess at left forefoot



Fig. 4 – Crack at right hindfoot



Fig. 5 – Sole of left hindfoot



Fig. 6 – Interdigital space and cuticles of right forefoot

TABLE 1: Further Physical Examination Records

Subject	Comments
Eyes	Remarkably and unusually reddened eyes
Teeth	Thin but visible tusk on left side with spot on upper edge where he rubs down tusk (most likely at the inside training wall). Right tusk is not visible, probably inside the sulcus. Normal molar growth, as far as it was possible to inspect
Tongue	Tongue and mucous membranes normal colour
Ears	Normal
Trunk	Versatile. Normal use
Skin	Extremely dry. Dead skin (scab) lightly at eye areas only
Genitalia	Normal
Faeces, urine	Colour & consistency are normal. Defecation/urination observed only once
Locomotion	General mobility and joint flexibility appeared normal
Appetite	Showed interest in produce/supplement. Intake of hay is rather slow



Fig. 7 – Right and left eye



Fig. 8 – Tusk (abrasion) and mucous membranes



Fig. 9 – Dry skin

4.2 Elephant Nutrition

TABLE 2: Type of food and supplements

Type of food	Details
Mountain hay + alfalfa	Staff mentioned that Bunka doesn't eat straw
Vegetables	Carrot, cabbage
Fruits	Pumpkin, apple, pear, banana
Branches	Offered 2-3 times per week Mulberry tree reported as Bunka's favourite browse
Daily supplement	Mix of 2.5 kg oats (soaked in water) and 2.5 kg mineral pellets
Additionally, staff reported to provide following food items during summer season:	
Grass	Fresh cut
Ice bombs	Produce inside water-filled buckets, frozen to huge ice cubes

TABLE 3: Daily feeding routine

Time of day	Type of food	Location
Morning	Hay, fruits, vegetables	Outside enclosure: produce for enclosure decoration and enrichment (additionally put into a boomer ball every now and then). Filling up the hay feeder.
Noon	Fruits, vegetables	Bucket of produce used for elephant training and/or footcare.
Afternoon	Mix of oats and pellets	Supplemental food placed on flakes of hay (inside barn or outside enclosure). Between 1/1:30 p.m.
Evening	Hay	Only if necessary, filling up the hay feeder inside the barn

During the visit, four thin branches were provided once, and caretakers assured that thicker branches of various tree species are commonly provided as well.

Hay feeder inside barn: Bunka pulls out the hay from the feeder's backdoor opening as the closing mechanism is broken, making it easier for Bunka to take big portions directly from there (instead of through the frontside gaps).

The quality of food items observed during the assessment is of average quality, however, his body weight suggests lack of volume. The feeding program is managed by the zoo's nutritionist, who is also responsible for the nutrition of all other animals kept at the zoo. It has been observed that Bunka also ate food items (such as popcorn, etc.) thrown by visitors from the visitor area into/close to the elephant's outside enclosure.

There is one automatic water trough installed at the training wall of the inside barn that serves as the only drinking source. 2 additionally installed drip feeders (1x inside barn, 1x outside yard) have been broken by Bunka, thus being non-functional. Bunka has access to the water trough nearly 24/7 (inside the barn is closed for cleaning procedures for approx. 1 hour per day).



Fig. 10 – Mountain hay-alfalfa-mix

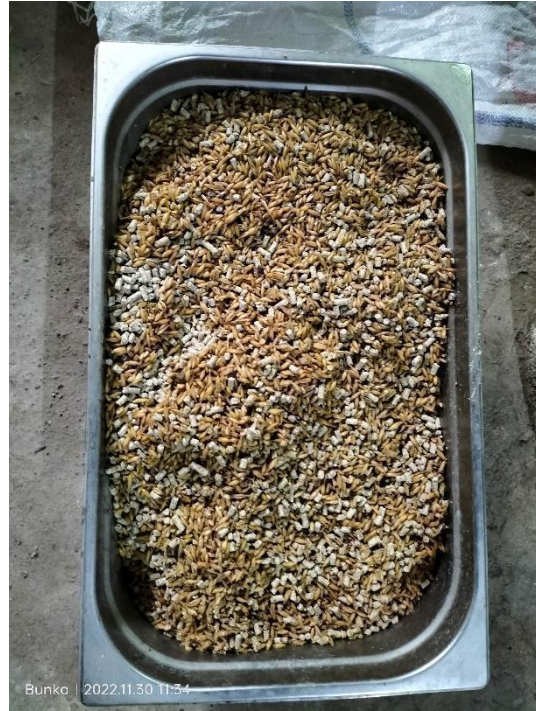


Fig. 11 – Daily supplement



Fig.12 – Produce for decoration



Fig. 13 – Water trough inside barn

4.3 Elephant Behaviour

Bunka displayed a relatively responsive but unsettled behaviour during training sessions (two sessions during the visit). Regarding the “Ear”-training, and when a zoo veterinarian was present or even when performing the “Ear”-training himself, Bunka’s behaviour changed to being more wary, and even showed more aggressive behaviour, mainly towards the veterinarian, but also towards the head caretaker. During such moments, Bunka quickly banged his head against the bars of the training wall.

Trained elephant behaviours/cues (note: some behaviours are more established than others):

- Presenting both forefeet: entire foot through opening as well as stepping on horizontal bar
- Presenting both hindfeet: entire foot backwards through opening
- Presenting right ear
- Trunk up
- Bending on carpal joints
- Backing up
- “Fetch the stick”



Fig. 14 – Training “Down” (bending on carpal joints)



Fig. 15 – Training right “Ear”

Bunka appeared mostly unsettled during both training sessions as well as when on his own.

There are no signs of him lying down to sleep in lateral recumbency, neither visible spots on the flooring of the inside barn, nor detectable spots on his entire body (marks of urine, faeces, hay, etc.). The caretakers reported that they never saw Bunka sleeping or resting in lateral recumbency.

Various types of stereotypic behaviours could be observed, some included one entire movement pattern only (foot swaying, head bobbing), others repeated more frequently and performed for longer periods (walking in circles) (See Section 5: Assessment of Behavioural and Psychological state).

4.4 Elephant Infrastructure

The entire area of Yerevan Zoo's property amounts to approximately 35 ha, of which 6 ha are developed and currently in use. The remaining 29 ha (approx.) are not constructed or in use for zoo animal husbandry purposes (Pers. Comm. Zoo administration, 2013).

TABLE 4: Elephant area - Size of Indoor and Outdoor Enclosures	
Inside barn (height approx. 4,5 m)	150 m ²
Outside yard (including elephant pool)	1.070 m ²
TOTAL AREA	1.220 m²



Fig.16 – Available elephant space: barn



Fig. 17 – Available elephant space: yard

TABLE 5: Indoor Area - Barn

Subject	Comments
Size of barn	2 pens (divisible by steel gate); 1x approximately 50 m ² , 1x approximately 100 m ² . Height approximately 4,5 m
Construction type	Closed building, solid construction
Type of flooring	Concrete floor
Drainage system	Yes. Gully cover in the middle of each pen
Type of barrier	Three sides of concrete walls, one side training wall
Gates	1x steel gate connecting both pens, 1x steel gate connecting smaller pen and outside yard
Training wall	Constructed at full length of bigger pen, including fixed hay feeder
ERD	No
Staff corridor	Along the training wall. Width approximately 2,5 - 3 m
Heating/Cooling	Industrial fan heaters blow warm air from the storage room (elephant kitchen) through a hole in the wall into the caretaker corridor. Latter adjacent to the bigger elephant pen
Floor heating system	No
Ventilation	No
Quality of air	Poor. No circulation
Lighting	1x skylight at roof of small pen, 2x skylights at roof of bigger pen. Poor incidence of natural light. Mainly artificial lighting provided by 3 flood lamps installed inside the staff corridor
Feeding devices	1x hay feeder fixed at the training wall. Broken lock system, thus Bunka pulls out hay from the back of the hay feeder as the hay feeder is open
Drinking devices	1x water trough (float valve system), 1x drip feeder (non-functional)
Enrichment	No



Fig. 18 – Main pen and training wall



Fig. 19 – Adjacent smaller pen



Fig. 20 – Steel gate to outside yard



Fig. 21 – Skylight and construction type



Fig. 22 – Fan heater outlet into staff corridor



Fig.23 – Fan heater inside storage room (elephant kitchen)



Fig. 24 – Water trough



Fig. 25 – Hay feeder



Fig. 26 – Gully cover and concrete floor



Fig. 17 – Staff corridor and flood lamps

TABLE 6: Outdoor Area - Yard

Subject	Comments
Size of yard	Approximately 980 m ² ; plus, a pool area of approx. 90 m ²
Moat	No. When the pool is empty, one side of the pool creates a falling edge (moat-like condition)
Type of ground	Concrete pool area. Various types of sand that became harder surface at most spots due to sand compaction
Drainage system	Layers of sand applied on natural soil
Type of barrier	Mainly concrete walls. Low wall (approx. 70 cm of height) with additional horizontal H-beam steel poles as an encircling barrier towards the visitor area
Gates	Solid steel gate separates the yard from the barn. Another gate (training wall) separates the yard from the outside staff depot
Training wall	Gate from yard to staff depot converted into training wall. Additional catwalk for staff outside yard, partly along steel pole fencing between yard and visitor area
ERD	No
Pool	Close to the visitor side. Dead-end construction, not filled with water
Shelter	No shelter in terms of sun, wind, rain/snow, visitors
Topography	Flat area
Feeding devices	1x hay feeder fixed at corner on top of wall
Drinking devices	1x drip feeder (non-functional)
Enrichment	1x boomer ball, 1x tire (not used), 1x enrichment tree (not used), 1x natural tree stump (placed as enrichment; not used), small mound of gravel sand (not used)



Fig. 28 – View towards inside barn



Fig. 29 – View onto yard



Fig.30 – Concrete wall as main barrier



Fig. 31– Catwalk for staff (e.g., for elephant training)



Fig. 32 – Elephant pool



Fig. 33 – Mound of gravel sand



Fig. 34 – Gate converted into training wall



Fig. 35 – Boomer ball

4.5 Elephant Management

TABLE 7: Subjects of Elephant Management

Subject	Comments
Number of elephant staff	In general, two caretakers. Additional emergency staff available if needed
Vet in charge	Responsible for the veterinary care of all animals at Yerevan Zoo.
Nutritionist in charge	Responsible for the nutritional management of all animals at Yerevan Zoo.
Training level of staff	3 elephants, Asian male <i>Grand/Elbrus</i> and Asian female <i>Maschka/Candy</i> both previously at Yerevan, as well as <i>Bunka</i> , provide the basis for collective experience in the management of elephants. A vocational education in the field of animal husbandry, a consistent and internal (elephant management) training program, and further experience with the management of other elephants do not exist.
Institutional guidelines and regulations	Internal elephant management-based documents, such as Standard Operating Procedures (SOPs), Emergency Plans or Safety Protocols not available.
Management system	Protected contact (PC), hands-off
Daily routine	Morning (yard): cleaning, food preparation, filling hay feeder Morning (barn): cleaning, disinfection, filling hay feeder Noon: elephant training session, potential elephant washing Noonish: caretaker-elephant-activity (Fetch-the-stick/boomer ball) Afternoon (barn): filling hay feeder (if need be)
Washing routine	During summer: hosing elephant 2x/day (cold water) During winter: hosing elephant 2x/week (warm water inside barn)
Daily training/exercise	Trained behaviours see paragraph 4.3 <i>Elephant Behaviour</i> . Communication with elephant (frequency of giving commands and providing cues) during training sessions appears rather noisy and unbalanced, resulting in a relatively absent-minded and unsettled elephant behaviour at specific times, and as a reaction to the inappropriate timing in regard to the performed training sequence of (1) given command/cue, (2) shown behaviour and (3) provided reward and with respect to true positive reinforcement
Tools used for training	Broomstick as target pole. Voice. Produce as reward
Elephant footcare	See also paragraph 4.1 <i>Elephant Health: visible body condition</i> . Deficiencies could be noticed regarding the daily elephant foot inspection and foot-care techniques; e.g. stone in sole went

unnoticed, improper crack treatment, untreated nail abscess, unattended interdigital space

Tools used for foot care Regular hoof knife, Swiss hoof knife, wood rasp, hoof rasp, brush

Staff working hours 9 am – 5 pm

Elephant confinement (during 24 hour-period) 7 hours access to both, yard and barn
17 hours confined inside a barn
Generally depending on the season of year

Facility open to public Yes. 365 days/year

Number of visitors <10 at the elephant enclosure during the 2-day inspection

Shows presented to public Fetch-the-stick/boomer ball



Fig. 36 – Fetch-the-stick



Fig.37 – Footcare tools



Fig. 38 – “Ear” training



Fig. 39 – Foot Care session

4.6 Physical and Environmental discussion points

Health

Comparing Bunka's general **mobility** with Asian elephant males living in a natural environment (or the natural locomotion behaviour of Asian elephant males), his walk appears remarkably and atypically slow. This could be due to general boredom or potentially could be the result of internal issues.

Bunka is underweight and small for his age (fig. 1 & 2). His overall **body shape** and Head-Body proportion is comparable with several elephant cases associated with zoo and circus environments and suggests potential internal issues as well. Lab-based blood tests and specialist evaluation of the results is highly advisable.

Observations highlighted **significant foot issues** (fig. 3-6), including a crack and abscess at the left forefoot, and a crack at right hindfoot (diagonally opposite foot and therefore consistent with expectation). Additionally, noted extremely smooth and thin soles on hind feet due to excessive abrasion caused by the concrete floor and compacted sand. These observations suggest lack of specialist foot care treatment. Bunka's poor foot condition is exacerbated by the lack of facility to lay down and sleep or rest as well as the lack of bathing opportunities that can alleviate constant foot pressure. If left untreated, these issues are common causes of elephant health decline in captive conditions, often resulting in elephant death.

The **eyes are unusually reddened** (fig.7). This could be caused by adverse weather conditions affecting ocular abnormalities such as conjunctivitis. Over 73% of captive elephants in Sri Lanka, who have to spend long hours standing on concrete, surrounded by dust, faeces and urine, suffer from various pathological eye diseases. This was in marked contrast to elephants kept on grass. Inadequate management practices and keeping facilities were defined as the main causes³.

Bunka displayed **musth** for the first time in 2019 which is abnormally early. The earliest wild elephants display musth is ~15 years and average ~ 23 years and may continue to 60 years⁴. This highlights the impact of solitary confinement and lack of socialisation.

During training and treatment sessions Bunka demonstrated **unsettled behaviour** by banging his head from time to time against the wall. This is observed commonly in elephants in similar living conditions and when managed without conspecifics (e.g., solitary). As was observed with Bunka, this imbalance often intensifies when the caretaker is not paying sufficient attention during elephant - caretaker interactions (here training, treatment, and play) suggesting that the specific preferences or needs of the elephant are not recognised and/or met. This may also be the result of dislike or fear by the elephant and/or staff. Generally, incorrect Protected Contact management can lead to heightened aggression, especially during musth, as well as further behavioural issues. It is important that these issues are managed while the elephant is still young otherwise, they may lead to more dangerous behaviours.

Nutrition

Overall **food quality** is average but lacks browse feeding, and his body weight suggests lack of volume. It should be mentioned that heightened stress may also be a cause of weight loss. There is also a lack of roughage, especially branches. Providing branches *ad libitum* especially during the night hours is significant to avoid dental (providing suitable abrasive surfaces for the teeth) and gastro-intestinal problems, as well as alleviating boredom to some degree. The only branches observed were thin and insufficient to keep Bunka occupied for any length of time.

Bunka spends long periods daily without food supply and without additional provisions **during the night** which leaves him stereotyping for unacceptably long periods of time.

There is only one **drinking** source indoors (fig. 13 & 24) and 2 non-functional/broken drip feeders.

Infrastructure

The enclosure does not meet the standard **size requirements** for one elephant, nor does it meet EAZA recommendations (Table 4).

EAZA's *Best Practice Guidelines for Elephants* (Appendix III; 2.1.5 Dimensions) state a minimum indoor facility for a mature bull of at least 160m², and a minimum outdoor area for adult bulls of 1.000m². These recommendations consider further aspects such as the social situation and environmental enrichment programs including elephant-specific exhibit design. Generally, the Minimum Standard guidelines provided by zoological associations (including EAZA) can never be adequate for elephants because they are informed by existing enclosure sizes and do not come close to meeting the interests of either male or female elephants, as they cannot provide sufficient space which is crucial to the well-being of elephants⁵.

The indoor barn space is small and dark as well as cold and damp in the winter.

The concrete **floor** is inappropriate and detrimental to elephants' feet as they require more species-appropriate substrate such as sand to lie on or to use for sand baths and digging, or at least rubber flooring and floor heating to prevent foot issues.

Natural **light** was absent or insufficient inside the barn and artificial lighting was required. These are positioned incorrectly and shine directly into Bunka's face. Continual exposure can cause permanent damage to the eyes. No supplemental UV-light source was noted.

The **air quality** inside the barn is poor with insufficient ventilation.

The outside enclosure does not meet basic requirements for **body care**, such as a water feature (the pool was empty), sand heaps and mud wallow to support elephant skincare, rocks or similar for scratching opportunities. No bathing water is provided during the extended winter period. This causes dry skin (fig.9), exacerbates foot issues, and restricts natural behaviour further.

Most of the **sand area** in the yard is compacted and not soft as expected. Gravel sand was specifically introduced but this is not appropriate for elephant use.

There is no **stimulation** available other than the boomer ball filled with food items once a day and occasional fruit and vegetables are placed around the enclosure during the day.

Also noted the incompatibility of Armenia's higher altitude continental **climate** and long winters (Yerevan average temp -7°C to 34°C) with that of the native tropical and wet habitat for Asian elephants and mean temperature of 27°C.

Management & Husbandry

The **footcare** programme lacks specific and target-oriented focus. Also, fundamental knowledge and experience is lacking as an observable abscess has been left untreated.

Generally caretaking staff is well meaning but inexperienced in elephant management and lacking a consistent and unified **training program**. It is understood that external consulting support is available, however, its effectiveness should be questioned considering the exceptions and inadequacies observed.

The following **safety** issues were noted. Inside the barn, a wooden podium is used for caretakers to stand sufficiently close during Bunka's "ear training" and when taking blood samples. Due to the

established working routine, staff are very close to Bunka's trunk risking injury or harm. The terrace accessible to the caretakers outside is unsafe as Bunka's trunk can reach anyone standing behind the handrail.

There was a **lack of work-related documents** (SOPs, guidelines, emergency plans, safety protocols). It is of utmost importance that every single person in charge of elephant care acquires the same basic knowledge to act consistently and according to related standards and guidelines – including safety protocols – also to create a working environment that is as safe as possible for the caretaker, as well as for the elephant.

Bunka may spend unacceptably **long periods (>17h) inside the barn**. Even if this only applies during the winter season, the length of the long winter season and the day:night ratio should be considered.

It appears that Bunka does not want to rest in a recumbent position and instead prefers to **doze or sleep while in a standing position**. This is most likely due to the concrete floor and lack of appropriate bedding material. This can have a tremendous impact on his physical and psychological well-being, as, for example, his feet need to carry his entire body weight 24/7. Thus, in the long term, foot issues become inevitable and rarely controllable. Furthermore, lack of rest drives further behavioural issues, such as aggression towards the caretakers, and is a serious welfare issue.

5. Assessment of Behaviour and Psychological State of Bunka

5.1 Introduction

Captivity places spatial, temporal, and behavioural restrictions on all animals. This is especially true for elephants, due to their large size, complex social structure^{6,7}, movement requirements⁸, and highly developed cognitive abilities⁹. These restrictions result in behaviours never seen in free ranging elephants, such as stereotypies, other aberrant behaviours, and could also result in physical impediments. The latter include impaired brain development, muscular deficiencies, health issues, shortened lifespan, impaired cognitive ability, and therefore constitute very poor welfare. Elephants' daily activities involve intellectual and cognitive challenges that depend on space: locating and manipulating a wide variety of food, remembering locations of water and seasonal food items, searching for mates, avoiding potential danger; caring for their young; forming social units, and coalitions with other elephants and much more.

These essential qualities conflict with the inadequate physical and social conditions found in captive environments, resulting in compromised welfare with long lasting detrimental psychological and physical effects^{10,11}.

Boredom seems to be a major concern in zoo elephants, which can result in frustration, depression, apathy and even death. To alleviate all these problems the field of Environmental Enrichment (EE) was developed, with an abundance of studies on how to better the life and welfare of captive elephants. Many tools^{12,13,14} have been developed to assess elephant welfare and include different ideas on how to make the life of captive elephants more acceptable. However, there is an inherent major problem always overlooked:

When the use of EE is required, there is a fundamental problem in the way the elephants are kept! EE is not a requirement of any wild-living elephant! This means captivity is ultimately totally inadequate and inhumane! EE cannot substitute what an elephant requires socially, spatially, nutritionally, behaviourally, physically, psychologically, or cognitively.

Elephants

- are large brained animals who display complex cognitive capabilities, great intelligence¹⁵, sentience¹⁶ and empathy¹⁷, with the ability to understand the intentions and emotions of others;
- are self-aware¹⁸;
- possess causal reasoning¹⁹;
- form tools and use tools²⁰;
- solve problems by insight²¹ and can work together to solve problems²²;
- are highly social mammals and live in unusually large social networks²³, with a highly organised structure involving strong family bonds that last a lifetime;
- have complex communication systems (olfactory, vocal, visual, auditory, chemical)^{24,25}
- are adapted to living in a variety of landscapes and their musculoskeletal system and feet²⁶ are an adaptation for walking long distances. Walking for health reasons is vital for humans and other animals, not only physically but for development of the brain.
- have exceptional long-term memory over vast distances²⁷.

Diseases

Captive elephants are subject to infectious diseases such as TB²⁸. The human variant is transmitted by humans to elephants, and an elephant can infect other humans and elephants on close contact, indicating two-way transmission. Most occurrences of human TB in zoos have been discovered in Asian elephants. A highly fatal haemorrhagic disease, the Endotheliotropic Elephant Herpesvirus (EEHV), occurs mainly in Asian elephants in captive situations²⁹. EEHV is triggered by stress and has been fatal in many zoo cases. To date a minimum of 287 cases world-wide for both species have been verified, with 270 for Asian elephants of which 222 died³⁰. Between 2003 and 2019, 142 EEHV HD cases have officially been reported for Asian elephants in Asia, held mainly in captive facilities.

Captive life is unnatural for elephants and can result in continual low-level stress³¹. Some factors that may have a negative impact on elephant welfare include inadequate and unnatural social and physical environments; lack of retreat possibility; high noise and light levels; frequent and long periods on chains or kept in small housings; climate conditions that may differ significantly from the animals' natural environment; and inappropriate nutrition. In addition, captive elephants have limited or no freedom to make meaningful, independent choices about their daily activity or social companions, and no significant level of autonomy over their lives. Both have proven to be necessary for their welfare and the absence this compounds the stress factor³².

- Males are **not** solitary as often falsely claimed, they require the company of other elephants³³, for the first 10-12 years the mother and family, thereafter other male company. Especially young males require older males for learning opportunities³⁴.
- Elephants are **not** a domesticated species. Whether captive held or wild living, they have the identical genetic make-up, therefore are behaviourally and physiologically identical and require the same social and ecological environment, to which their species has adapted to.
- Keeping an elephant alone, without other conspecifics, is harmful to mental and physical health, and welfare^{35,36}. Research involving other mammalian species has shown that social deprivation can cause profound and lasting psychological effects in animals. These include self-mutilation, disturbance in perception and learning, total apathy and withdrawal symptoms, anxiety behaviour³⁷, aggression³⁸, and compromised cognitive processes^{39,40}. There are indications of similar problems in single captive elephants, including self-mutilation, anxiety, stereotypies, and aggression.

Humans are unable to replicate the social environment necessary for an elephants' mental and physical health and well-being. Therefore, elephants should not be held solitary unless it is unavoidable for medical reasons and only short term.

5.2 Methods

The detailed assessment of behaviour and psychological state of Bunka is based on a series of videos taken prior to the official visit (during October 2022) and during the 2-day official visit in November.

The most useful videos were from the uninterrupted observations, when zoo staff were not aware that someone was videoing. On the official days there was much disturbance and people around the enclosure, or interacting with Bunka, which obviously are not representative of Bunka's daily life and unfortunately greatly impeded observations. Despite this, what was seen and recorded gave sufficient impression of the usual life of Bunka.

5.2.1 Actogram

An actogram was created on site during the two-day observation period, by recording **general activities** of Bunka every 5 minutes. These were: feeding, walking, walking & feeding, walking searching (smelling along the ground), standing (doing nothing), standing searching, push/carry ball (concrete boomer ball), sand bath, stereotyping, play, trunk through bar (reaching through the outer bars to search for something).

5.2.2 Space use

In addition, the location of Bunka within the enclosure was noted at 5 minute intervals alongside the actogram. The Yerevan Zoo elephant enclosure was divided into a grid of 10 squares; A1-A3; B1-B3; C1-C3; D4/D5 (Fig 1). The locations, as well as the duration of time spent in each block were noted and tallied to calculate the total time spent in each block during the observation period (16/10/2022, 29/11/2022, 30/11/2022). The data was further processed to create a polygon grid feature layer in ESRI – ArcGIS Online. A spatial join was done with the polygon and data layers to create a heat map showing the usage of the enclosure over the video duration.

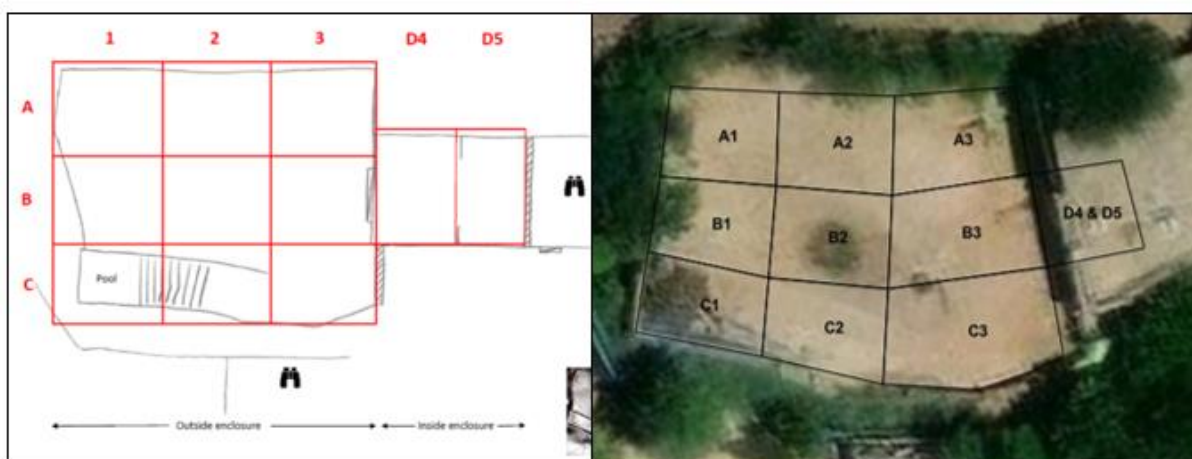


Fig 1. Grid of enclosure used to describe the location of Bunka. D4 and D5 are inside the house. The pool contained no water.

5.2.3 Detailed behaviours

The videos were analysed second by second noting each small behaviour of Bunka on an Excel sheet. An ethogram was compiled based on his behaviour (See Appendix I):

5.2.3.1 General Activities: (in addition to above in the actogram)

These can occur any length of time:

Feeding hay or fruit/vegetables or branches; walking slowly or fast or in a circle; drinking; circling around himself; climb on ball; stereotyping (head bobbing, rocking, walking in a circle); inspecting

object; pick up small bits and place them into the mouth (this was not feeding, just picking up tiny pebbles, crumbs, single bits of hay, dry leaves, or food thrown by visitors), or picking up imaginary objects (vacuum behaviour).

5.2.3.2 Detailed short behaviours

These are generally short events but can occur several times in a row and include any behaviour done with the trunk, ears, legs, feet (for details see Appendix I). For the analyses these were grouped into categories using the most frequently occurring behaviours (>1%):

- Ambivalent (trunk swing between legs; trunk lip or mouth; trunk curled; tail curled over backside; trunk in mouth; lift front foot; touching any part of the face, hanging trunk rotate)
- Stereotyping either head swaying or stereotypical walk in a circle or figure of 8
- Boredom behaviour (trunk up reaching; trunk on objects (bar or wall), searching ground; reach through bar; pick up).

These categories are based on our own previous research results and references (Online ethogram <https://elephantvoices.org>).

General remarks were noted such as demeanour of Bunka, visitors throwing food, caretakers coming into the enclosure or engaging with Bunka and any other occurrence, not captured by the ethogram alone.

5.3 Data analyses

5.3.1 General daily activities

The behaviours of the actogram were calculated and divided by the total observations to receive percentages.

5.3.2 Space use

A heat map was done for the space use of the enclosure.

5.3.3 Detailed behaviours

Behaviours recorded in the outside or inside enclosures were kept separate. Inside there was obvious disturbance, as the caretakers went about their job, washed Bunka and the observers were present, which was unusual for Bunka. Despite this, as it was the only opportunity to assess him inside, the videos were analysed. All occurring behaviours were counted separately and divided by the length of observation time for the respective locality (inside or outside) to obtain frequencies per minute. To create the diagrams, only behaviours occurring more than 1% of the time were included. Certain behaviours found to occur in repetitive sequences with no obvious goal or meaning were assigned to 'stereotyping' or 'boredom' accordingly. For example: step-stand, step-stand, step-stand, etc.

Going through the motion of picking up something tiny and either touching the lip or in the mouth, but with nothing edible, was assigned to boredom. This is called a *vacuum behaviour* (going through the motions but with no achievable goal and is typically seen only in zoo elephants with nothing to do and poor welfare and is never seen in free range elephants).

5.4. Results

5.4.1 General Activities

5.4.1.1 Actogram

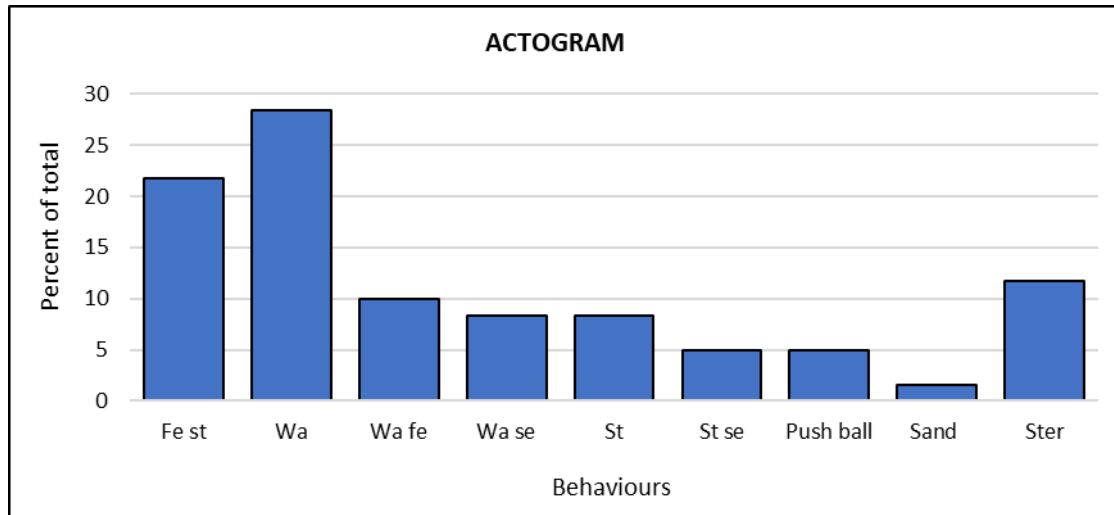


Fig 2. Actogram of daily activity of Bunka in the outside enclosure

Fe st = feeding standing; *Wa* = walking; *Wa fe* = walking feeding; *Wa se* = walking searching; *St* = standing; *St se* = standing searching; *Push ball* = pushing the boomer ball; *sand* = throwing sand on body; *Ster* = stereotyping

Figure 2 shows the daily activity of Bunka in the outside enclosure. He hardly showed any other behaviours than feeding, which took mainly place in the corner (A3; Fig 1) where the feeding rack is situated, walking and searching the ground for food or something to do. In one instance, he pushed the boomer ball from near the empty pool to the corner (C1 -A3) and climbed on it with one foot to reach the hay, which is stacked on the roof. Stereotyping consisted of slight rocking of the head, but he also displayed a walking stereotype, by which he always walked in the same circle around the pole as if to make the distance longer. Or he walked along the wall, kicked his front leg as if wanting to make a step forward, but then changed direction and walked in a circle. On one occasion he just circled around himself on the spot for no visible reason.

A few other behaviours, such as walking fast after the ball, or bringing it to the caretaker to be filled with something edible only occurred when the caretakers stood on the back wall and either gave him titbits or threw him the boomer ball.

5.4.1.2 Space Use

Figure 3 shows that Bunka spent most of his time, during the observation period, in blocks A3, B2, D4&5, and block B1. Bunka spent almost 30% of the total observation time in block C3. The least amount of time was spent in blocks A1 (2%) and B3 (2%).

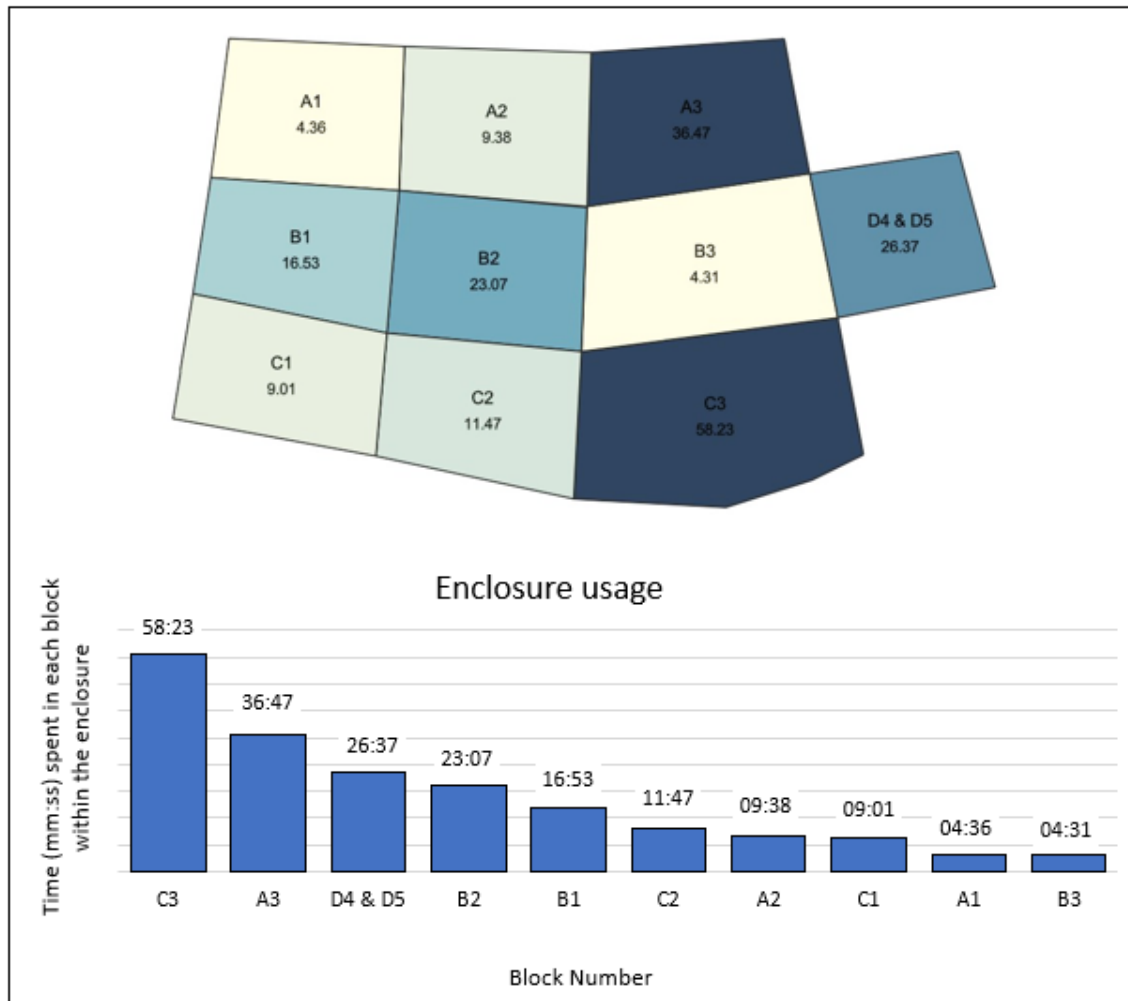


Fig 3 (a) Heat Map and (b) Histogram illustrating the time spent within each block (mm:ss) that was created to demonstrate the space use of Bunka in the enclosure.

5.4.2 Detailed Behaviours

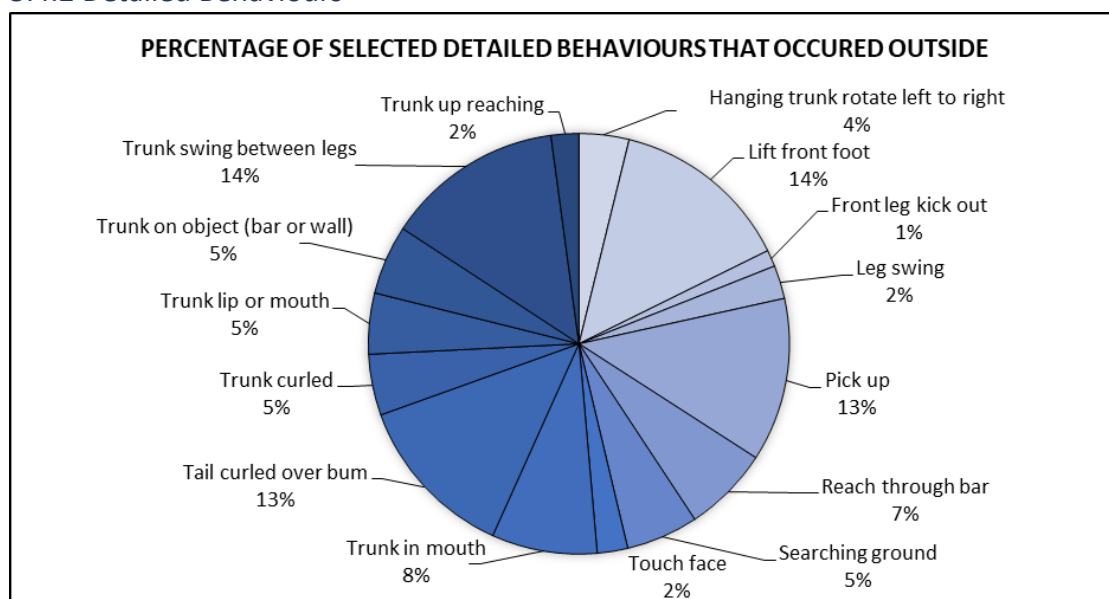


Fig 4. Percentage of detailed behaviours occurring in the outside enclosure

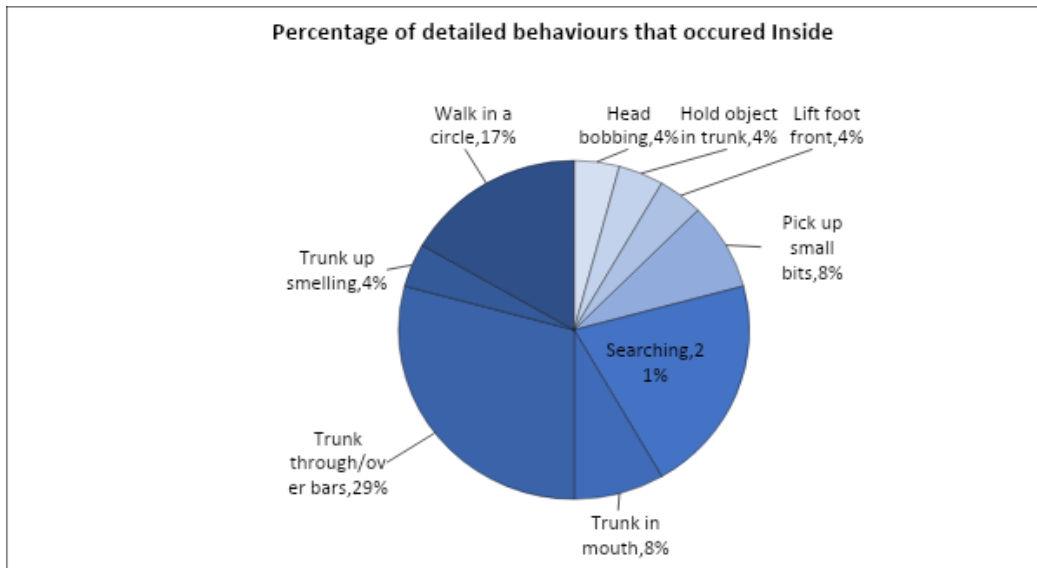


Fig 5. Percentage of detailed behaviours occurring in the inside enclosure

The diagrams of detailed behaviours (Figs 4 & 5), show clearly that most, if not all behaviours are either related to searching for something (which equates to boredom), ambivalent behaviour, or some form of stereotyping (Fig 6 A & B, Fig 7).

Inside the small house, Bunka has not much else to do than put his trunk through the bars trying to reach the hay or searching for something edible. His movements are highly limited due to the small space. Although he is washed during the morning whilst inside, he is forced to spend a minimum of 17 hours or more inside this tiny dark place, especially during winter months.

Ambivalent and boredom related detailed behaviours were further analysed when he was inside and outside. Unless he received something to eat, this was all he did. Fig 6 A & B show the frequencies per minute.

Categories

The most occurring behaviours were grouped into categories:

5.4.2.1 Boredom Related Behaviour

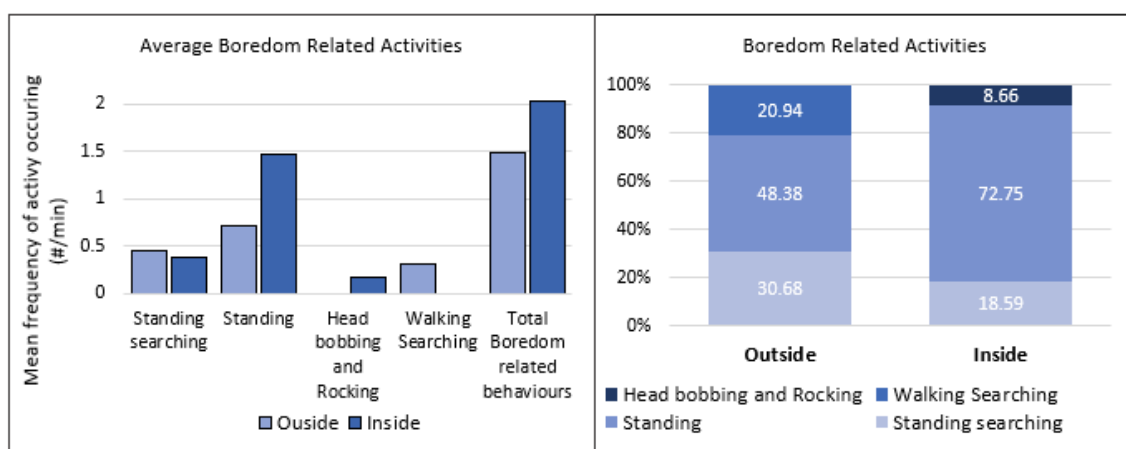


Fig 6 A & B. Boredom related behaviours for inside and outside. 6 A Frequency per minute; 6. B Percentage for each of the behaviours. Stereotyping is included herein, as it also in the broader sense is a sign of nothing to do.

Figure 6 A & B show the frequency of boredom related activities per minute as well as the percentage of time spent in each of the named behaviours for inside and outside. Bunka mainly walked around or stood searching the ground looking for something to eat or do. Clearly when in the small house Bunka shows more boredom related activities, but in general apart from feeding hay, all else are boredom activities.

5.4.2.2 Stereotyping Behaviour

The stereotyping, which includes the circular repetitive movements, such as walking in a circle or in a figure of eight, inside and outside, are depicted in Figure 7. It appeared as if Bunka wanted to extend the distance when walking from one point to another and making more steps to kill time. Especially when confined to the small house he had no other alternative but to walk in a tight circle. He even walked in a circle as if wanting to extend the time and distance when walking from one point to another.

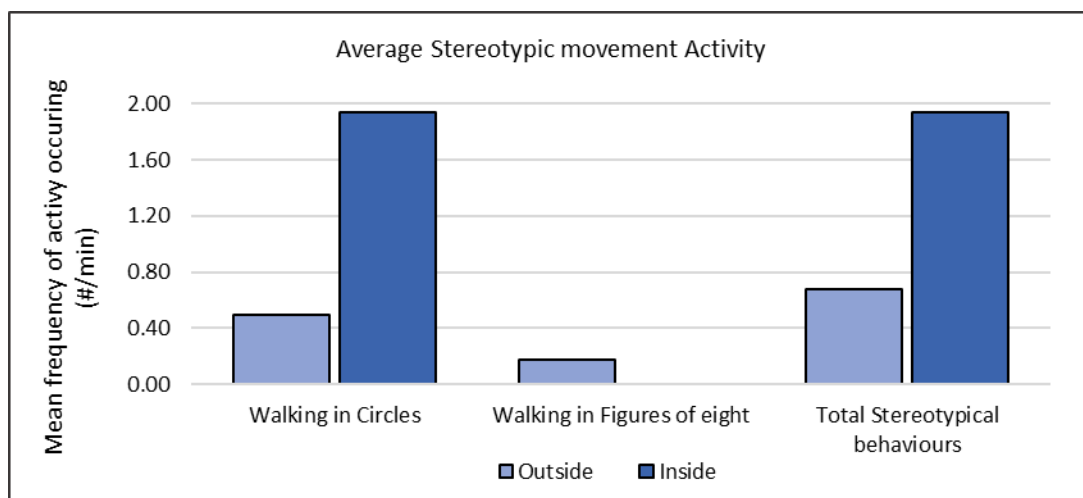


Fig 7. Frequency per minute of stereotypic movements for inside and outside

A few sequences which were repetitive with no goal were recorded and can therefore be ascribed to a form of stereotyping. This was mainly walking one or two steps searching - standing, a few steps searching – standing, a few steps searching – standing, etc. and the other obvious one was picking up of small or imagined objects and moving the trunk towards or to the mouth (pick up-trunk lip, pick up – trunk lip, etc.). This latter behaviour is termed *vacuum behaviour* and occurs if there is an inner motivation to do something (e.g. searching and finding food), so the genetically fixed motions are done, but the goal is not achieved (in this case ingesting; Figure 8).

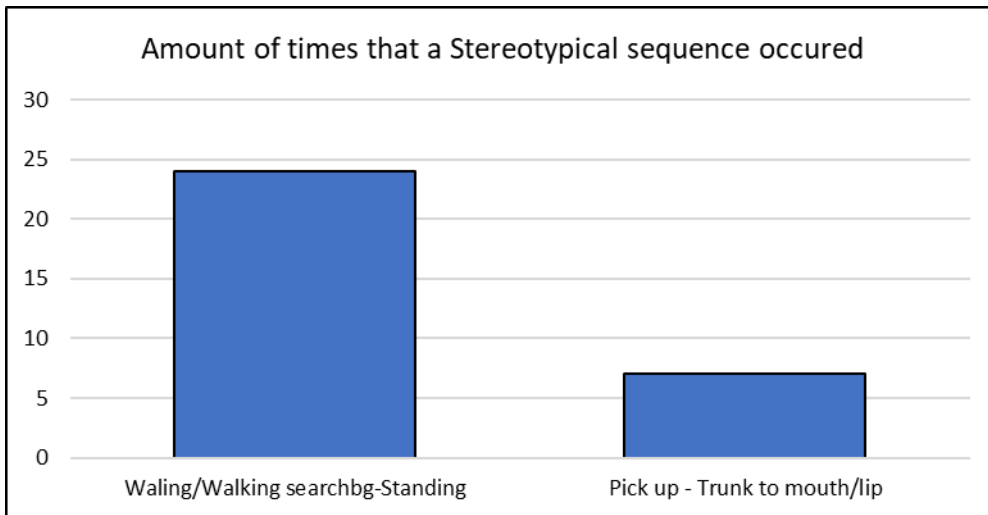


Fig 8. Stereotypical repetitive behavioural sequences (walking searching – standing; pick up trunk to lip or mouth)

5.4.2.3 Ambivalent Behaviour

These behaviours have no distinct function, but show indecision, nervousness, or nothing to do. Elephants are inquisitive, intelligent animals, requiring cognitive challenges, or satisfying motivation, and their senses are constantly alert. This typical captivity behaviour includes moving the trunk, playing with the trunk such as twisting it, touching the body, swinging the trunk, and others. The frequent touching of the face indicates that he is searching for reassurance. Much like a person will do when uneasy, e.g. scratching the head, touching the face, etc. (Fig 9).

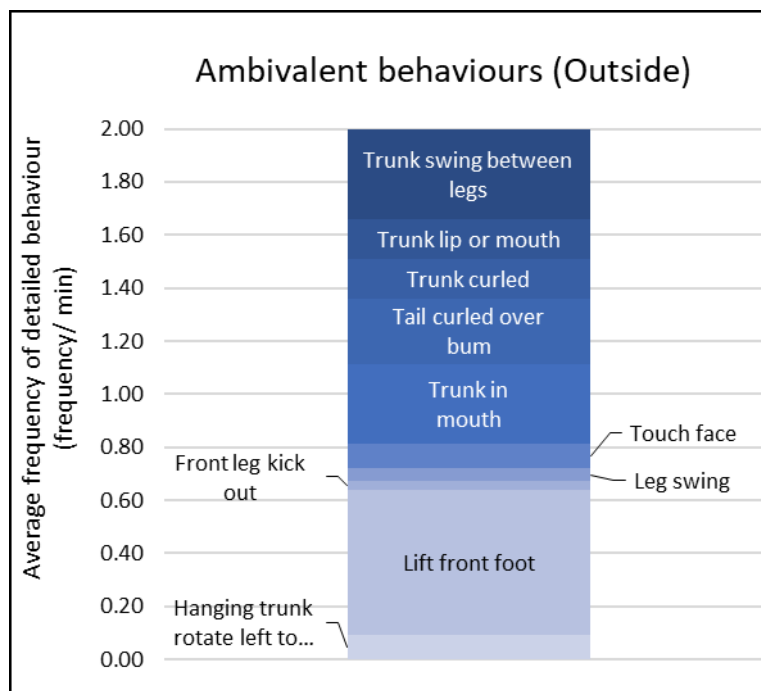


Fig 9. Frequency per minute of Ambivalent behaviours in the outside enclosure

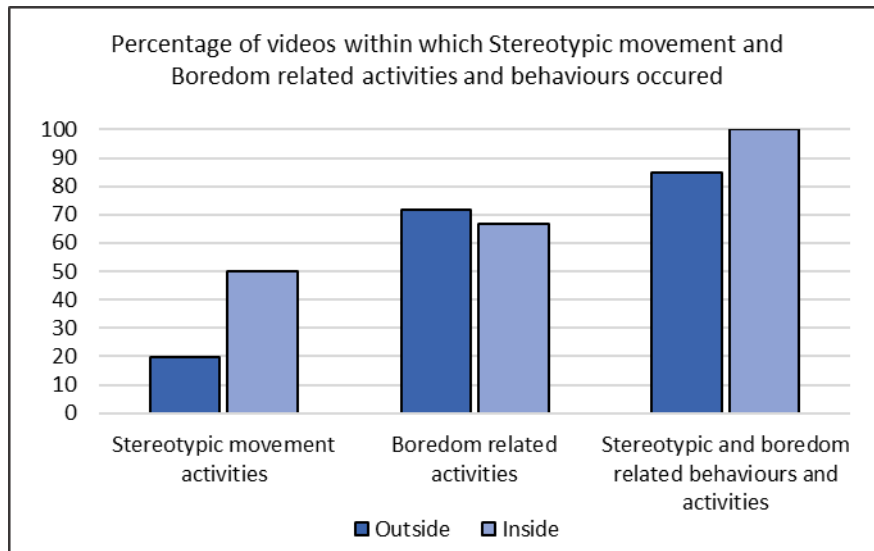


Fig 10. Percentage of videos within which stereotypic movements and boredom related behaviours occurred.

We calculated the percentage of videos within which stereotypic movements and boredom related behaviours occurred (Fig 11 A & B). All videos contained a great amount of boredom behaviour and well over 80% of videos contained some form of stereotyping.

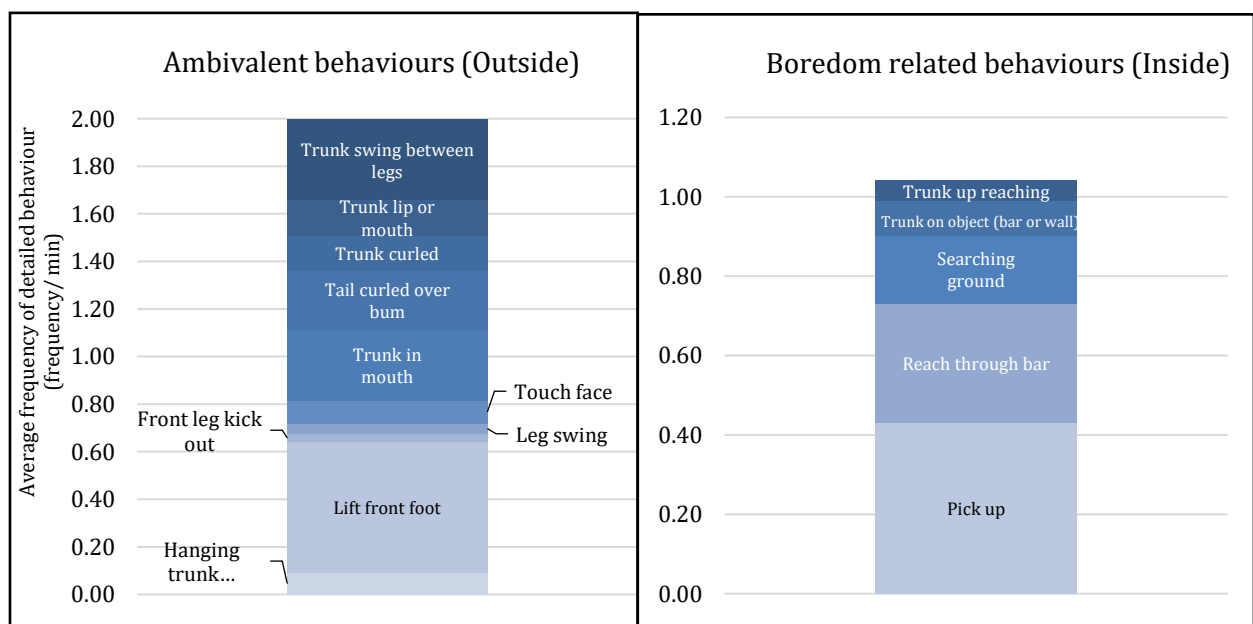


Fig 11 A & B. Ambivalent and Boredom detailed behaviours inside and outside

5.5 Discussion of Behaviour

5.5.1 Activity

As is clearly visible from the actogram, Bunka's activities are reduced to the bare minimum. Whatever he does, is done very slowly as if to kill time. He is aware that there is nothing to do and nothing exciting will happen. He is showing signs of depression.

Elephants are adapted to living in a variety of landscapes and walking long distances⁴¹. Home range sizes have been shown to extend to 400 square kilometres or more for Asian elephants^{42,43}. They have exceptional long-term memory and mapping skills to locate food and water over vast distances and time periods. A normal natural behavioural repertoire consists of at least 5 major behavioural classifications: Social (includes sexual, play, raising young, and communication), Nutritional (foraging, food acquisition and preparation), Body care (sand bath, mud wallowing, swimming, scratching, and rubbing), Locomotion, Resting. Each of these groups has a large variety of different categories and behaviours with 266 found for African adult male elephants⁴⁴. It can easily be assumed that Asian elephants have quite as many, if not more, as they produce further vocal signals⁴⁵ not found in African elephants, and their natural nutrition requires different types of food preparation methods to the elephants living in African savannas, for which 40 different food acquisition and preparing methods have been defined (walking, reaching, and smelling with the trunk; digging, kicking, stabilizing with the feet; prying, levering, and breaking with the tusks; pulling, ripping, breaking, defoliating, cleaning)⁴⁶. At the Pinnawela Elephant Orphanage in Sri Lanka, where a two-year long-term study was conducted, 33 different methods (biting, tearing, breaking, stripping, pulling, turning, holding with tusk, trunk or feet, slitting, beating, planning, sweeping, throwing, crushing, kicking, etc.) have been identified for captive elephants⁴⁷, where a variety of branches, stems and leaves were offered to the elephants. Food items are fixed and manipulated with forefeet, trunk, tusks, mouth, and molars. Many more behaviours can be assumed for wild elephants who also feed on a variety of grasses, which requires different techniques of preparing.

Tool use has been identified for many species, including elephants, with 40 described for captive Asian elephants⁴⁸.

Out of the main classifications Bunka is only able to express a bare minimum of behaviours pertaining to Nutrition and Resting. The food was restricted to hay, cut fruit and vegetables, and on a few occasions, small thin branches or sticks. No behaviours from the classifications Social or Body Care are possible as nothing is provided for Bunka to use, such as mud wallows, sand heaps, water feature, scratching and rubbing rocks/post. Locomotion is reduced to a few steps only, which includes stereotypic walking in a circle.

Elephants spend approximately 75% of their life searching for and acquiring adequate food and water. The physical activity and mental stimulation involved in the search for food and their manipulation provides a naturally enriching environment that contributes to the health and mental wellbeing of elephants, which is not available to Bunka. Most of these activities require movement. In fact most of an elephant's life consists of walking and moving, except for short bouts of resting during hot hours or during the very early hours of a day.

Bunka spends a minimum of 17 hours a day in a tiny concrete cell, and in winter probably more!

This is completely inhumane, and no elephant should be subjected to this type of life.

5.5.2 Space Use

In the wild much of what an elephant does involves cognitively engaging activities that depend on space. Locating and manipulating a wide variety of food items; remembering the location of water during a drought⁴⁹; searching for potential mates⁵⁰; deciding where to go⁵¹; and which partners to choose or avoid. Discriminating between the individual scents^{52,53}, voices⁵⁴, and appearances of hundreds of familiar and unfamiliar individuals, including friends and foes, relatives and non-relatives, higher-ranking and lower-ranking competitors, and friendly and unfriendly other species⁵⁵, is, as evidenced by their behaviour, a continually engaging activity.

With such limited space and no incentive to walk, Bunka is deprived of any above behaviours and deprived of any cognitive stimulation. Exercise has been shown to be a vital factor not only for muscle and joint development and maintenance, but also to stimulate neurogenesis, improve learning and mental performance and promote brain plasticity⁵⁶. This is corroborated by latest findings, that the brains of captive elephants are greatly impoverished, to the degree that different levels of the cerebral cortex are affected: decrease in cortical thickness, smaller capillary diameter, decreased soma size and fewer glia cells per neuron, less complex dendritic branching, fewer dendritic spines, and less efficient synapses⁵⁷.

Furthermore, mobility is important for joints, muscles, and general health. Lack of movement tends to promote obesity, lameness, bone- and joint diseases such as osteoarthritis, foot problems and much more. It has been estimated that 50% of elephant deaths in captivity are caused by lack of mobility⁵⁸.

Free living elephants are on the move at least 20 hours a day⁵⁹. Unique and morphologically peculiar, the relatively inflexible, pillar-like legs and cushioned feet of elephants have evolved to support their vast weight⁶⁰ and enable them to walk efficiently over long distances on rough surfaces. The design of the muscular structures, too, matches the precise requirements of heavy weight-bearing. The foot is highly sensitive⁶¹. The elephant's large body and rather inflexible limb joints, so well adapted for energy-efficient locomotion, are particularly vulnerable to arthritis in a sedentary captive environment⁶². The pads of an elephant's foot are designed for walking long distances on uneven and rough surfaces, not for standing on concrete. As a result of the predominantly stationary existence on smooth surfaces, the feet of captive elephants wear unevenly, causing improper posture of the feet, and consequently of the legs and spine, leading to painful arthritis and other joint and vertebral column problems. Elephants need to walk to stay healthy. These features are the very reasons for their unsuitability in captivity, specifically the traditional zoo.

The activities experienced by a free-ranging elephant motivate an active mind and keep a vigorous body fit. Behavioural deprivation is a central problem to zoo animal welfare. If an animal is motivated (or genetically primed) to perform a certain behaviour through absence of conditions or lack of suitable stimuli has been likened to suffering⁶³. If a "vacuum behaviour" is performed, it is implied that the motivation must be very high. It has been argued that vacuum activities may reduce motivation. Total deprivation can result in frustration and stereotypies, or aggression, apathy, and depression. Suffering covers a wide variety of different unpleasant emotional states such as fear, boredom, pain, grief, hunger, etc.⁶⁴.

5.5.3 Detailed Behaviours

Out of the 23 defined behavioural contexts for wild elephants that form part of their repertoire⁵⁸ Bunka only displays Feeding, Ambivalent, Boredom and Stereotyping behaviours. Neither Boredom nor Stereotyping behaviours are observed in the wild.

He spends most of his time, waiting for the next food to be given, or looking for something to do, and this is hour by hour, day by day, month by month, year by year. Given that for over 17 hours per day during winter Bunka is locked up in a concrete room, it is surprising he has not become aggressive, or shown more aberrant behaviours. No amount of enrichment, even if there were any, can adequately provide the mental and physical stimulation or relief from suffering⁶⁵ for Bunka.

5.5.4 Solitary keeping

Studies involving other mammalian species have found that chronic social isolation induces alterations in several neurochemical systems, including those associated with anxiety-like behaviours, neuropsychiatric disorders, and increased aggression and depression-like symptoms⁶⁶.

Other profound and lasting psychological effects include disturbance in perception and learning, total apathy and withdrawal symptoms, anxiety behaviour, self-mutilation, aggression, and compromised cognitive processes. Similar problems have been observed and documented in single captive elephants, including self-mutilation, anxiety, stereotypies, and aggression. Structural changes to the brain in response to social isolation have also been observed in species other than elephants and may underlie cognitive and behavioural deficits and induce neuroendocrine disturbances^{67,68,69,70}.

Biologically inappropriate social conditions, such as incompatible companions or complete isolation, have been shown to alter and adversely affect the functioning of the mammalian hypothalamic-pituitary-adrenocortical (HPA) axis, which mediates the body's stress response. The effects are particularly evident in response to additional acute stress in animals already dealing with stress of isolation. Chronic isolation has been associated with changes in gene expression and glucocorticoid resistance, which heightens risks of inflammatory processes, reduced immunity, and disease⁷¹.

The suggestion by the zoo to bring in a female is NOT the appropriate solution and goes against elephant social requirements. Elephants are not monogamous, nor do they have a social structure of male and female pairs. Females need female company and males need male company; however, the sexes also need to socialise for mating at times. Males will walk from female group to female group in search of oestrus females and remain only as long as to ensure that he is the sole breeder.

5.5.5 Stereotypies

Impoverished environments and social isolation have been shown to disrupt normal function of motor control pathways in several species, resulting in stereotypic behaviours. Stereotypies are defined as repetitive, unvarying, and functionless behaviours^{72,73}, and they indicate a neural attempt to cope with an impoverished environment. Stereotypies are commonly seen in captive⁷⁴ and, in particular, solitary elephants in the form of repetitive body motions or locomotion, (e.g., head bobbing, rocking, and swaying, pacing). These behaviours are often linked to poor welfare, as well as life-threatening health problems such as foot disease. There is a great amount of literature on how to alleviate the problem in zoos by environmental enrichment, such as feeding schedules, olfactorily or auditory stimuli, play, problem solving, etc. All deal with single symptoms and not the causes. There are many different causes why an animal stereotypes, such as insufficient space, insufficient activity, social deprivation, isolation, frustration, boredom, expectation, physical restraint, inability to reach a desired goal, unfulfilled motivation, inappropriate partner, etc. To alleviate the problem, the cause(s) has (have) to be recognised. However, the fact that animal stereotypes show poor welfare and that there is a problem in the management.

With the knowledge we have acquired in the past 2-3 decades on animal emotions, feelings, brains, requirements, etc, it is time to go beyond the 5 Freedoms and move on to the Five Domains model⁷⁵ to include mental and psychological wellbeing⁷⁶.

Zoo guidelines such as from WAZA, EAZA, AZA, BIAZA and others, state that zoo enclosures must allow all natural behaviours to be possible. No captive facility can offer anything close to a natural free-living life, but the life Bunka is forced to live should be unacceptable to any Zoo Organization

6. Future considerations

There are plans to expand the current enclosure to approx. twice the size (3000 m²). The table below outlines some of the possibilities mentioned by staff.

TABLE 8: Possible options for the future			
Option	Pros	Cons	References
Bring in one female	Provides much needed company	Elephants are not monogamous and don't live in pairs. Females need female company and males need male company. There is no guarantee that they will get on, or even breed. Goes against natural requirements and behaviour of elephants goes against EAZA requirements	De Silva et al 2011 Vidya & Sukumar 2005 Nandini et al 2017
Bring in one male	Provides much needed company	Two elephants is against EAZA guidelines Only larger family groups are recommended	EAZA guidelines
Add several males	Provides company. Can deal with surplus bulls of other zoos	A large complex area is needed. Environmental complexity (topography, vegetation, physical separation) enables the bulls to have close contact and avoid each other when desired. Bulls in musth must be able to be separated, but NOT isolated. This requires the inside boxes and the outside facility to be separated if necessary and the costs are extremely high for such a facility.	Veasey 2006
Add 2-3 elephants mixed sexes	Holding a 'family' unit and a few bulls of different age classes is recommended, but to "replicate the social unit in nature" the facility would require a minimum of 8 females with offspring and a few bulls of different ages	Bulls must be able to be separated from females and other males if not compatible or during musth, especially Asian bulls must be kept separate from females. Bulls may NOT be kept in isolation for long periods. Aggression within herds or between males and females confined in small spaces are common. Staff must be adequately trained to deal with bulls in musth or aggressive females.	BIAZA guidelines De Silva et al 2011 Sukumar 1992

Considerations

		Should they breed, the facility must be able to cater for peace for mother and calf. Eventually the facility will be too small. Costs for such a facility including appropriate housing are exorbitantly expensive.	
Transfer Bunka to another zoo	Depending on the size and structure of the facility, number, sexes and amenability of the elephants on site, this could be positive (short term) or negative.	Depending on the size and structure of the facility, number, sexes and amenability of the elephants on site, this could be positive or negative.	
Transfer Bunka to a reputable, credible sanctuary	In all respects this is the second-best option to the wild. A sanctuary can provide the appropriate social company, freedom of choice and be as near to a natural environment as possible. Bunka would have a chance of a life with conspecifics, allowing him to develop autonomy and recover as he goes through the rehabilitation process. It would have the expertise and provide proper 24/7 care, generally not available in a zoo. Costs would not be greater than building a new enclosure large enough to harbour a family group with bulls. It would give high status and global credibility to the zoo and Yerevan for doing the correct thing.	A properly planned transport has minimal risks and done by experts ensures success. It has been done in the past e.g., Kaavan from Pakistan to Cambodia and many zoo and circus elephants within the USA between states or from other countries in South America to Brazil. Transport has even been done between the UK and Australia and many zoos have moved elephants from Western to Eastern Europe, including Russia and vice versa.	

7. Summary

The findings in this report highlight that Bunka is experiencing visible detrimental physical and psychological effects due to the conditions of his captivity. Based on evidence from similar captive environments, his condition is very likely to escalate and lead to further physical deterioration and problematic behaviours if no drastic action is taken.

During a two-day inspection, the team observed both physical abnormalities in his condition and inadequacies in his welfare provision and enrichment.

Bunka is underweight, with signs of undernourishment, which combined with the restricted environment, is causing weak body posture and inferior muscle condition.

Critically, Bunka is already experiencing significant footcare issues with cracked nails, an abscess and overworn foot pads due to inadequate care and inappropriate substrate. Poor footcare is an extremely serious condition for captive elephants and can trigger serious health issues and often leads to early death.

The enclosure does not meet the minimum size requirements for captive bull elephants, it does not provide adequate opportunities for stimulation (minimal enrichment available) nor does it support natural behaviours (no water bathing, sand dusting, grazing opportunities etc). Furthermore, owing to Yerevan's climate which is incompatible with the needs of a tropical species, in the winter Bunka spends unacceptably long periods (17 hours) inside a small barn with unsuitable flooring, lighting, ventilation, lack of enrichment and without options for Bunka to rest in recumbency.

The inadequate physical and environmental conditions compound to Bunka's observable psychological stress, loneliness, and boredom.

With such limited space and no incentive to walk, Bunka is deprived of any cognitive stimulation. Detailed scientific analysis in section 5.4 highlights that out of the 23 defined behavioural contexts for wild elephants, Bunka only displays Feeding, Ambivalent, Boredom and Stereotyping behaviours. Neither Boredom nor Stereotyping behaviours are observed in the wild.

He displays 'vacuum behaviours' going through the motions but with no achievable goal and was viewed both inside and outside his barn walking in circles or figures of eight, which forms a repetitive behaviour and stereotyping which are indicators of mental stress.

His activities are reduced to the bare minimum. Whatever he does, is done very slowly as if to kill time. He is aware that there is nothing to do and nothing exciting will happen and showing signs of depression. Elephants are intelligent and inquisitive animals yet without stimulation or objectives Bunka shows indecision and nervousness. The frequent touching of his face with his trunk is indicative of searching for reassurance.

Further, biologically inappropriate social conditions, such as complete isolation or incompatible companions, have been shown to alter and adversely affect the functioning of the body's biological responses adding to further stress and/or aggressive behaviour.

Summary & Recommendations

Such behaviours are often linked to poor welfare, as well as life-threatening health problems which are likely to exacerbate with time.

Zoo guidelines such as from WAZA, EAZA, AZA, BIAZA and others, state that zoo enclosures must allow all natural behaviours to be possible. No captive facility can approximate a natural free-living life, but the life Bunka is forced to live should be unacceptable to any Zoo organisation.

8. Recommendations

We conclude that Bunka's needs cannot be met in the current zoo environment.

We understand plans have been suggested for an expansion of the elephant enclosure and the importation of other elephants. But the social sphere of elephants is highly complex and bringing in other elephants, whether male or female, is fraught with hazard and considerable costs to the zoo. There is little guarantee at all Bunka would connect with another elephant if one was brought to the zoo. Our strongest recommendation is not to proceed with this.

We recommend Yerevan Zoo consider the option of releasing Bunka to an established elephant sanctuary. This would be the best option for his future because credible sanctuaries offer large natural spaces that support elephants' innate behaviours. They also have established management practices that support elephants to re-assert a degree of autonomy and offer opportunities for socialisation and more natural living.

Moreover, elephant sanctuaries:

- a) have the expertise to address specific elephant needs through protected contact and positive reinforcement management
- b) can provide specialist and holistic medical care specifically developed to address elephant needs
- c) are experienced in perceiving elephant cues and supporting their rehabilitation processes.
- d) have the possibilities to provide 24/7 care (all of which is usually not possible within a zoological environment and to this extent).

In recent years several zoos have closed their elephant exhibits for ethical and/or financial reasons. They include zoos in the United States, Canada, France, United Kingdom, Pakistan and India. Most reported no change whatsoever in their attendance and in several cases there was actually an increase in attendance⁷⁷ The transportation of elephants to such sanctuaries now follows a careful and ultimately successful procedure, whether by road or air. And the elephants are being surrendered to sanctuaries that offer space, appropriate climate, wild habitat, and opportunities for companionship if they choose to form such bonds.

Yerevan Zoo has a historic and inspirational opportunity to position itself as a zoo that understands the science of elephant captivity and to be recognised globally as a world leader in compassion towards a species that countless recent research has suggested is unsuited to captivity, specifically zoo life.

The publicity spin-off if Bunka was to be released would reflect in a globally positive way for both Yerevan Zoo and Armenia. Our suggestion would be the return of Bunka to his genetic home-range that we conclude to be Southeast Asia, where credible sanctuary options are available.

Summary & Recommendations

A suggested option for Yerevan zoo would be to transition towards becoming an eco-park focusing on the rich native fauna and flora of Armenia. An excellent example of how a traditional zoo transformed into an ecopark and surrendered its elephants is Mendoza in Argentina. These are popular and profitable with locals and visitors who appreciate and learn more about the native ecology of the country. As Yerevan zoo already demonstrates with inspirational presentations of rescued native bears.

We would also recommend Yerevan Zoo consider embracing state-of-the-art technology like augmented reality (holographic simulations) to replace Bunka perhaps through a collaboration with Yerevan university that has established a reputation in the field of AI and robotics. This could create a unique brand for Yerevan Zoo, and be a regional first, and become a powerful education tool. We would be able to advise on this technological innovation.

Bunka faces a future of mental and physical disintegration on his current trajectory, so we urge you to act on his behalf before it is too late.

We would like to place on record our gratitude to the zoo's administration for your helpful cooperation during the inspection and we offer you cooperation and assistance for future steps to act in the best interests for Bunka.

Appendix I

Details of behaviours of Bunka noted from videos
bite trunk – placing the trunk or trunk tip into own mouth
bite bar – taking the bar into the mouth
bite stick, not feeding – placing a stick into the mouth, but not chewing or ingesting it
ears out – spreading the ears out sideways
ear flap – flapping the ear a few times. Can be a behaviour of irritation. If regularly flapped it's for thermal regulation during hot days, but this was not seen in the Autumn months
defecate - passing of faeces
digging/scooping with foot lucerne, sand – using the foot/toes to loosen sand or help scoop up hay or sand into the trunk
hold object in trunk – holding or carrying an object in the trunk
lift foot front - lifting a foot and keeping it lifted without walking
lift foot back – as above
front leg kick out (stereotyping) – kicking the front leg forward as if to walk, but then turning or standing
front leg swing – lifting a front foot and swinging back and forth, a behaviour of indecision
drinking -
hanging trunk rotate – the trunk hangs down but the front section near the tip is rotated from side to side – a form of playing or manipulating the trunk, when there is nothing to do
head bobbing – head bobs up and down, stereotyping behaviour
pick up small bits – picking up tiny bits, such as pebbles, crumbs etc, but not feeding
trunk on object (bar or wall) the trunk is placed on the bars or wall
reach through bar – reaching through the bars to search for something, or waiting for peanuts
searching/smelling along the ground – trunk tip scans the ground smelling around
searching/smelling objects – trunk tip held towards an object to inspect it
throw sand on body – scooping up strata and throwing it onto the body or head
touch face – trunk tip touches the face

Appendices

touch face with hay – trunk tip holds a bunch of hay and touches the face
touch ear – trunk tip touches an ear
touch eye – trunk tip touches or rubs an eye
touch body – trunk tip touches own body
touch leg – trunk tip touches a leg
touch belly – trunk is swung between front legs to touch belly
touch bar/ inspect – the enclosure bars are smelled and touched
touch tusk – trunk tip touches a tusk
touch object – an object is slightly touched and smelled
trunk lip or mouth – trunk tip touches the lip
trunk in mouth – the trunk is placed inside the mouth, either with or without food
trunk up smelling – trunk is curled upwards to investigate/ smell the air
trunk up reaching – trunk is stretched upwards to reach something (e.g. caretaker feeding tit bits, or haystack)
trunk tip curled – the trunk tip is curled inwards and sideways
trunk curled – the whole trunk is curled inwards and sideways, a behaviour of unease or nervousness
trunk between front legs – trunk is held between the front legs
trunk swing (around or sideways) – the trunk is swung around as if playing with it
trunk swing between legs – trunk is swung back and forth between legs – boredom behaviour
tail curled over bum – the tail is curled on top of back side
tail slap between legs – tail is vigorously slapped between hind legs
urinate – passing of urine
weaving rocking – the head or front of body is rocked from side to side = stereotyping
stereotypical walk circle/figure 8 – walking in a circle with the apparent reason or a figure of eight
walking backwards – walking a few steps backwards

Appendix II

Arguments often brought up why elephants should be kept in zoos

Argument	Reasons why these are wrong	References
Its o.k. to have elephants in zoos	<p>Today where Asian elephants are on the brink of extinction and categorised as highly endangered (CITES Appendix I), in times of climate change and dwindling natural habitat and the demise of so many species, it is not acceptable to keep elephants in captivity any longer for entertainment purposes.</p> <p>Elephants cannot express many of their natural behaviours in captivity, as required by all zoo associations</p>	<p>EAZA guidelines (Appendix III)</p> <p>WAZA guidelines (Appendix III)</p>
Seeing elephants in a zoo makes people aware of their plight and they donate more to conservation	<p>For elephants to suffer a lifetime for a few people who might appreciate them and feel inclined to help them is not warranted in any way.</p> <p>There is no proof that people seeing bored elephants doing nothing or stereotyping in an unnatural environment will take anything home or do anything for conservation. It has just become acceptable to see animals dominated by man and kept captive.</p> <p style="text-align: center;">This attitude must change!</p>	<p>Dawkins 1988</p> <p>Dawkins 2008⁷⁸</p> <p>Vanitha et al 2016⁷⁹</p> <p>Mason 1991⁸⁰</p> <p>Mason et al 2004⁸¹</p>
Zoos are here to entertain and be a place for urban citizens to go to	<p>The idea of zoos for entertainment is antiquated and all zoo guidelines put conservation in first place. However captive elephants DO NOT contribute to the wild populations in any way, there is no record of any elephants being brought back to the wild for conservation.</p>	<p>EAZA guidelines</p> <p>WAZA guidelines (Appendix III)</p>
Elephants are better off in a zoo than the wild with less stress	<p>Elephants do badly in zoos, they do not reproduce well, their life expectancy is much shorter, their social lives have been totally disrupted.</p> <p>Most don't breed at all and are deprived of the very basics of an elephant's life: raising calves and a socially free life.</p> <p>Elephants in captivity suffer.</p> <p>The brains of captive elephants are negatively affected.</p>	<p>Clubb et al 2008⁸²</p> <p>Clubb & Mason 2002⁸³</p> <p>Dawkins 2008⁸⁴</p> <p>Jacobs 2020⁸⁵</p>

	<p>Visitors of zoos induce stress, aggression, vigilance, and avoidance behaviours in animals.</p> <p>Elephants have adapted to coping with natural stress, whereas the stress in captivity is harmful to health and mind.</p> <p>In the wild they still have freedom of choice, which they do not have in captivity.</p> <p>The dwindling forests for Asian elephants are the very reason elephants must be protected in the wild and not taken out of the population to captivity.</p>	<p>Sherwin et al 2015a⁸⁶</p> <p>Sherwin et al 2015b⁸⁷</p> <p>Suárez et al 2017⁸⁸</p>
<p>Elephants provide education options for children</p>	<p>There is no educational value in seeing one or two bored, depressed and abnormally behaving elephants in a cage, out of their natural social and ecological environment.</p> <p><u>On the contrary:</u> Children learn that it is acceptable to keep elephants out of their social environment and that it is fine to keep animals in cages.</p> <p>They do not learn to respect animals or nature but learn that man can and must dominate animals and keep them for pure entertainment.</p> <p><u>They do NOT learn anything about:</u></p> <ul style="list-style-type: none"> ● their complex social structures ● their different socialites of males and females ● their highly developed communication systems (visual, auditory, chemical, vocalisations) ● their intelligence, cognitive abilities, and emotions ● the current poaching crisis ● the illegal ivory trade ● their conservation ● their feeding requirements ● their vast movements and capability to find food and water ● any interesting aspects of their physiology and sociology ● how they raise their young ● or any respect for other animals or nature and much more. 	

Appendices

<p>Elephants are a draw card for the zoo</p>	<p>If there is a breeding herd which produces calves, then visitor numbers rise dramatically short term. In general, it is seen that people do not spend much time in front of the elephant enclosure as watching a bored elephant doing nothing is not entertaining. So this is a misconception.</p>	
<p>Zoo elephants assist conservation</p>	<p>Elephants in zoos do NOT contribute to conservation, on the contrary wild elephants consistently have to be taken out of the wild to replenish dwindling captive elephant groups. Whereby brutal methods have to be used, causing huge lifelong trauma and stress for the many elephants, the ones taken, and the families left behind.</p>	<p>Bradshaw et al 2005⁸⁹ Bradshaw & Schore 2007⁹⁰ Rizzolo & Bradshaw 2016⁹¹</p>
	<p>There are many ways to draw people to the zoo and even provide real entertainment, experience and education by using modern technology.</p>	

Appendix III

Selected statements from various zoo guidelines

EAZA Standards for the Accommodation and Care of animals in Zoo and Aquaria 2014

1.2 Accommodation – Space, Exercise and Grouping

1. Provision of a physical space that is appropriate to the species, taking account of their three-dimensional needs.
2. Animals to be provided with an environment, space and furniture sufficient to allow such exercise as is needed for the welfare of the particular species.

1.4 Social grouping management

1. Facilities for keeping animals shall allow maintaining a social unit that reflects the life history of a given species in the wild, and thus may need to have sufficient flexibility to adapt towards changing group dynamics.
2. Before introducing a new individual to a social group, an assessment should be made of its adaptability to the group and consequently the implications for its individual welfare, as well as the welfare of the animals in the social group.

1.5 Encouragement of natural behaviour and minimising of unnatural behaviour

1. Animals kept in EAZA collections should be encouraged to perform as much of their natural behavioural repertoire as possible and acceptable. Whenever possible unnatural behaviour should be prevented or actively discouraged. Important elements in achieving this are enclosure design, environmental and behavioural enrichment and feeding regimes (see above).

1.6 Furnishings within Enclosures

1. Design must take account of behavioural needs and behavioural management of the species, allowing adequate spatial separation between individuals or subgroups.
2. Provision of a rich environment of appropriate structures within the space that enable the animals to express their behavioural repertoire as fully as possible.
3. Animal enclosures to be furnished, in accordance with the needs of the species in question, with such items as bedding material, perching, vegetation, burrows, variety of substrates, climbing structures, appropriately designed nest boxes, refuges and hiding places and pools.
4. Provide appropriate environmental and behavioural enrichment.

EAZA Position Statement on the Evolution of Elephant Management Systems at Member Zoos - July 2019

“Zoologists specialising in the care of elephants in zoos learned over the years that breeding success and overall animal welfare were significantly enhanced by the retention of social

herd structures similar to those in the wild, which allow the animals to express a more complete range of natural behaviours.”

WAZA Code of Ethics and Animal Welfare 2003

3. Exhibit Standards

“All exhibits must be of such size and volume as to allow the animal to express its natural behaviours. Enclosures must contain sufficient material to allow behavioural enrichment and allow the animal to express natural behaviours. The animals should have areas to which they may retreat, and separate facilities should be available to allow separation of animals where necessary,....”

AZA Standards for Elephant Management and Care 2012

Temperature

Standard – Outdoor – Daytime: All elephants must have access to shade when they are exposed to direct sunlight. Water suitable for drinking or bathing must be available daily or at greater frequency as needed to meet the elephant’s cooling needs in the ambient environment.

Explanation: Water, mud, dust, soil or sand must be available for elephants to dust themselves to assist with thermoregulation. Sufficient sheltered areas must be provided to protect elephants from adverse weather. When sunlight is likely to cause overheating or discomfort of elephants, sufficient shade by natural or artificial means shall be provided to allow all elephants protection from direct sunlight. Shade areas must be provided to assure that all individuals can have access to shade when desired and that subordinate elephants are not excluded from the shade. Elephants exposed to temperatures below 40°F (5°C) for longer than 60 minutes, must be monitored hourly to assess the potential for hypothermia. If needed to prevent hypothermia, supplemental heat, an area of direct sunlight protected from wind/precipitation, access to indoor barn stalls or other options for thermal management must be provided for the elephants.

Standard – Indoor: Indoor holding areas must be able to be heated to a minimum temperature of at least 55°F (13°C) at all times of the year. One room must be capable of maintaining a temperature of at least 70°F (21°C) and be free of drafts for accommodating sick or debilitated elephants. Care should be taken to control excessive heat indoors. At elevated indoor temperatures, the use of fans, cross-ventilation, access to water, cool substrate, allowing elephants access to an outside area or other cooling measures must be employed as needed.

Outdoor space

Standard – Indoor: Indoor holding areas must be able to be heated to a minimum temperature of at least 55°F (13°C) at all times of the year. One room must be capable of maintaining a temperature of at least 70°F (21°C) and be free of drafts for accommodating sick or debilitated elephants. Care should be taken to control excessive heat indoors. At

elevated indoor temperatures, the use of fans, cross-ventilation, access to water, cool substrate, allowing elephants access to an outside area or other cooling measures must be employed as needed.

Behaviour

Standard: The facility and program provide a complex physical and social environment which stimulates natural behaviors, social interactions and activity levels resulting in healthy, well-adapted elephants.

Facility must have sufficient structures for all elephants to participate in all ranges of natural behaviors. Elephants are a social species and herds often perform activities together, such as feeding, drinking, walking, resting, and wallowing.

BIAZA Management Guidelines for the Welfare of Zoo Animals - Elephants

“Elephants must only be kept in zoos as part of an overriding conservation mission so that they are in actively managed breeding programmes. These follow the same guidelines as for other EEP programmes, i.e. the captive population is managed to maintain an agreed level of genetic diversity and size commensurate with that required to sustain a captive population for a minimum period of 100 years.

Their presence must enable progressive educational activities and demonstrate links with field conservation projects and benign scientific research, leading to continuous improvements in breeding and welfare standards.

Zoos must exercise a duty of care so that standards of husbandry practices, housing, health and welfare management are humane and appropriate to the intelligence, social behaviour, longevity and size of elephants. All zoos should aim to continuously improve welfare standards.”

3.3.1 Social Structure

Elephants are one of the most social mammals and this should be borne in mind when managing them in captivity. Zoos must maintain elephants in as appropriate a social group as possible so that welfare needs, education and conservation potential can all be fully realised. The best way to achieve this is to replicate the social organisation seen in the wild. The broad similarity between the social organisation of African and Asian

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