Is Gas Stunning/Killing Ethical?

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The Question

- *Prima facie* ethical to slaughter animals.

- Anything about gas stunning/killing that makes it:
  - Unethical?
  - More ethical than other methods?

Focus

- Animal Welfare

- Not:
  - Economic considerations
  - Environmental effects

Gas Stunning.

(Mostly European initiative until recently.)

- To minimize carcass damage re. high current stun. (In Europe.)

- To minimize handling of conscious birds.
  - Birds are stunned before being shackled.

Controlled Atmosphere Stunning

- Atmospheric change to produce lack of oxygen or excess of carbon dioxide.
  - Nitrogen, argon, carbon dioxide, oxygen.
- CAS Categories
  - Anoxia
  - Hypercapnic Anoxia
  - Hypercapnic Hypoxia
  - Hypercapnic Hyperoxygenation
  - Atmospheric Depressurization
- Single Stage or Multi-stage
- Pre-unload or Post-unload

Comparison of different gas mixtures

8 s Accession:

	CO_2 %			
	35	45	55	65
Unconscious (s)	37	34	30	28
% Alive, 2 minutes	90	20	0	0
% Alive, 5 minutes	50	0	0	0

Immersion:	49% CO_2	90% Ar	90% (Ar with 30% CO_2)
Unconscious (s)	19	18	19
EEG Silence (s)	76	62	50

Raj and Gregory, 1990; Raj et al. 1992.

Comparison of different gas mixtures

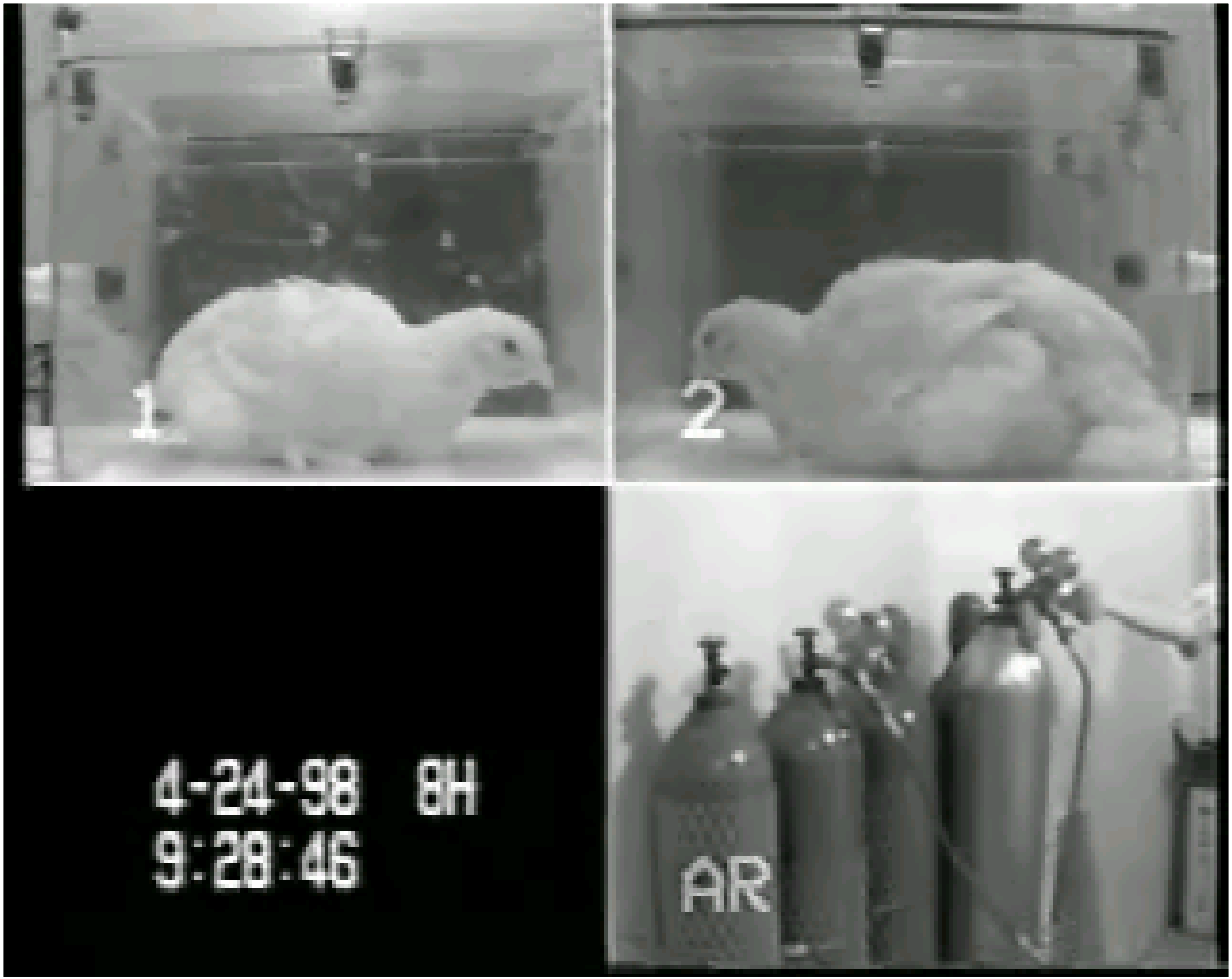
	Ar	60%Ar/30%CO_2-in-air	40%CO_2/30%O_2-in-air
LOP (s)	16	17	32

Lambooij, et al. 1999

Anoxia

- Argon, nitrogen
  - Residual oxygen to about 2%
- Single stage, stun-to-kill
- LOP fast
- Not detected
- Convulsive head jerking before LOP
- Strong convulsions (wing-flapping) after LOP
- EEG. Conscious around convulsions?
- Popcorn effect (abusive of conscious birds?)

Anoxia



Hypercapnic Anoxia

- 30% carbon dioxide with argon or nitrogen
  - Residual oxygen to about 2%
- Single stage, stun-to-kill
- LOP fast
- Detected
- Deep breathing (gasping); head shaking
- Strong convulsions (wing-flapping) after LOP
- EEG. Conscious around convulsions?
- Popcorn effect

Hypercapnic Anoxia

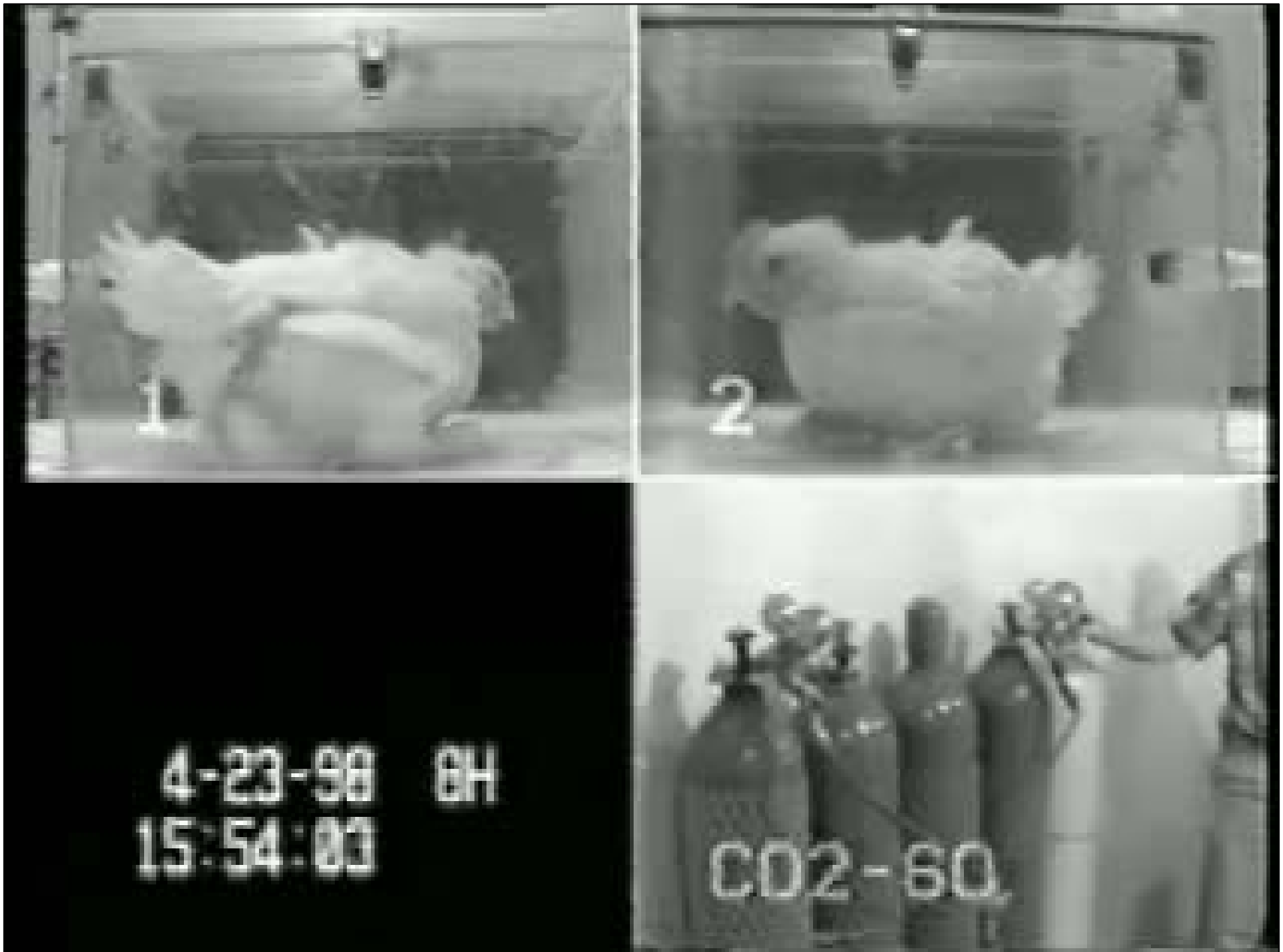
Carbon Dioxide

- Mandibulation, deep breathing, head shaking
- Deep breathing
  - Gasping? Breathlessness?
    - Avoidance response not strong
- Head shaking
  - Irritation of nares and throat?
    - But HS occurs below trigeminal nociception threshold (~ 50% $CO_{2)}$
- Can produce anesthesia and suppress convulsions if allowed to take effect

Hypercapnic Hypoxia

- Carbon dioxide mixed in air; various concentrations
- Single stage or multi-stage (stun or stun-to-kill)
- LOP fast or slow
- Detected
- Deep breathing (gasping); head shaking
  - Stunning can be done below nociception threshold
- Convulsions suppressed at lower CO_2 levels
- EEG. Unconscious before convulsions

Hypercapnic Hypoxia (60% CO_2 in air)



Hypercapnic Hyperoxygenation

- 30% carbon dioxide, 30% oxygen, 40% nitrogen
- Stun only
- LOP slow
- Detected
- Deep breathing (gasping); head shaking
  - Stunning done below nociception threshold
- Convulsions suppressed
- EEG. Unconscious before convulsions

Hypercapnic Hypoxia (30% CO_2 in air)

CAS Working Group
(May 27, 2005, London, England)

- Welfare implications of different gases used for CAS
  - European and U.S. CAS researchers, industry and UK government reps
- Conclusion
  - Welfare-related differences between CAS atmospheres exist
  - But differences not so great nor unilateral to give an advantage to one over the others.

Atmospheric Depressurization

- New development
- Single stage
  - Pressure for stun-kill is 0.20 to 0.30 atm.
- Information needed re. welfare effects

Is Gas Stunning/Killing Ethical?

- Is bird welfare acceptable?
  - First four categories -Yes
  - Atmospheric depressurization -??
- Compared to electrical stun
  - Is stun better? -??
  - Is bird handling better? -Yes
  - Is work environment better? -Yes
  - Economic cost-benefit? -??