

Smoke Assessment and Properties of Cigarettes and Smoke

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This presentation offers an explanation for different sensory judgments of cigarettes based on a hierarchy of approximation, using TPM standard delivery data, per puff delivery, and different volume and velocity scales. The term "smoke elasticity E_n " was defined as the amount of smoke a smoker can take from a cigarette, and an equation describing this phenomenon incorporates realistic volume data from typical brand smokers. Elasticity can be designed into a cigarette using tobacco blend and pressure drop components, and it has been used as a measure of the degree of sophistication of opposition product developers in the German market.

An equation for smoke strength was also described incorporating terms for delivery per puff, standard puff volumes, and probable puff volumes of the smoker population for that brand.

A study of the influence of directing smoke to specific areas of the mouth by use of mouthpieces was presented, and preliminary results showed a negative correlation of mouthful feeling and impact.

P. Dunn

PD/svp

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Smoke Elasticity

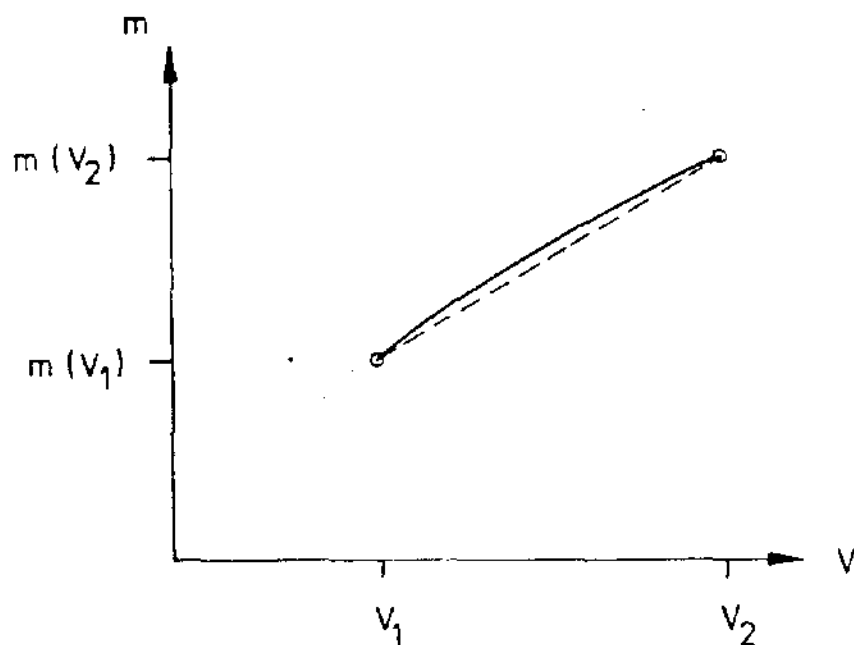
The elasticity of a cigarette is a measurement for the amount of smoke a smoker can take out of a cigarette. The elasticity is measured for a realistic range of smoking behaviours.

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$$E_n = \frac{m(V_2) - m(V_1)}{(V_2 - V_1)}$$

$m(V_2)$ delivery per puff at puff volume V_2

$m(V_1)$ delivery per puff at puff volume V_1



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$$S = m(V_0) + E \cdot (\bar{V} - V_0)$$

S : „strength“

$m(V_0)$: delivery per puff for puffvolume V_0

V_0 : standard puff volume (DIN)

\bar{V} : probable puff volume of the smoker
population for that brand

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sample	"strength" rating in relation to sample "A"	TPM (DIN)	TPM puff number	TPM for 1. + 2. puff	$E \left[\frac{\text{mg} \cdot 10^2}{\text{ml}} \right]^{*})$
A	-	13.2	1.47	1.6	1.67
B	stronger	15.1	1.61	2.0	2.0
C	"	13.2	1.65	2.1	2.33
D	"	12.6	1.47	2.1	3.67

*) $V_1 = 35 \text{ ml}, V_2 = 50 \text{ ml}$

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sample	"strength" rating in relation to sample "A"	mg TPM (DIN)	TPM puff number mg	TPM for 1.+2.+3.+4. puff mg	E $\left[\frac{\text{mg} \cdot 10^2}{\text{ml}} \right]$
A	-	14.0	1.49	3.5	2.3
B	stronger	14.0 (+ 3 %)	1.54 (+ 3 %)	3.6 (+ 3 %)	3.3 (+ 43 %)

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sample	"strength" rating	TPM (DIN) [mg]	TPM puff number [mg]	E $\left[\frac{\text{mg} \cdot 10^2}{\text{ml}} \right]$	pressure drop [mm W.G.]
A	strongest	9.6	1.11	2.22	97
B	remarkable less stronger than A	6.1	0.78	2.41	100
C	remarkable less stronger than B	4.8	0.52	1.35	100
D	less stronger than C	5.4	0.61	2.19	97
E	less stronger than D	9.0	0.99	2.17	127

weak E D C B A strong

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Hypothesis 1 : the mean puff volume for
low tar brands is higher
than 35 ml

Hypothesis 2 : the degree of puff volume
increase is lower if the
pressure drop of the
cigarette increases

$$S = m (V_o) + E (\bar{V} - V_o) \quad (2)$$

$m (V_o)$: per puff delivery for puff volume V_o

V_o : 35 ml

\bar{V} : 60 ml

$$\bar{V} = \frac{k}{z} \quad (3)$$

z : pressure drop

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sample	strength rating	TPM-rating	$\frac{\text{TPM}}{\text{puff}}$ -rating	E-rating	S-rating ^{*)}
A	1	1	1	2	1
B	2	3	3	1	2
C	3	3 (-)	3 (-)	3	3 (-)
D	3 (-)	3 (--)	3 (--)	3 (--)	3 (--)
E	3 (--)	2	2	3 (-)	3

*) \bar{v} in relation to pressure drop

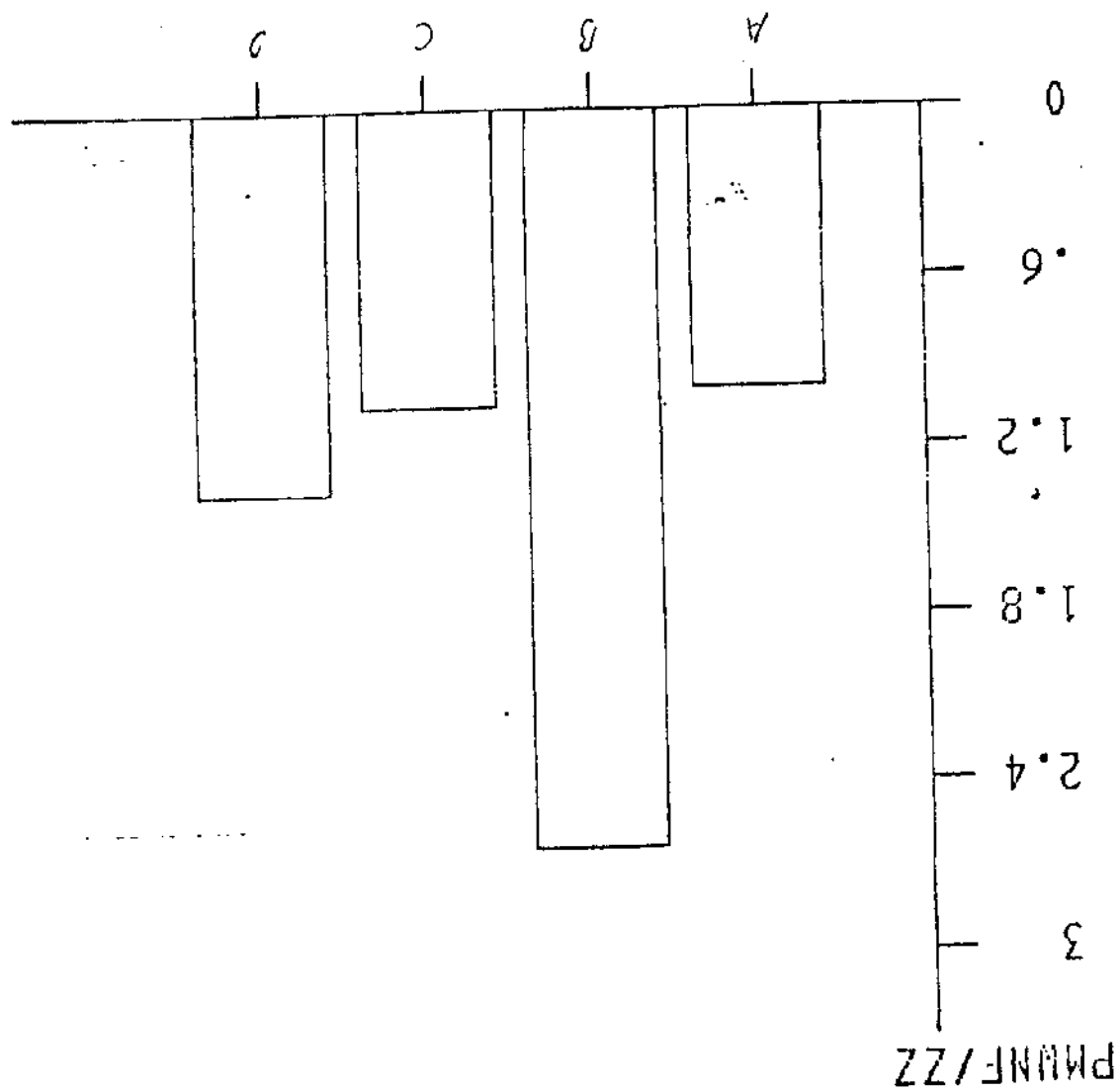
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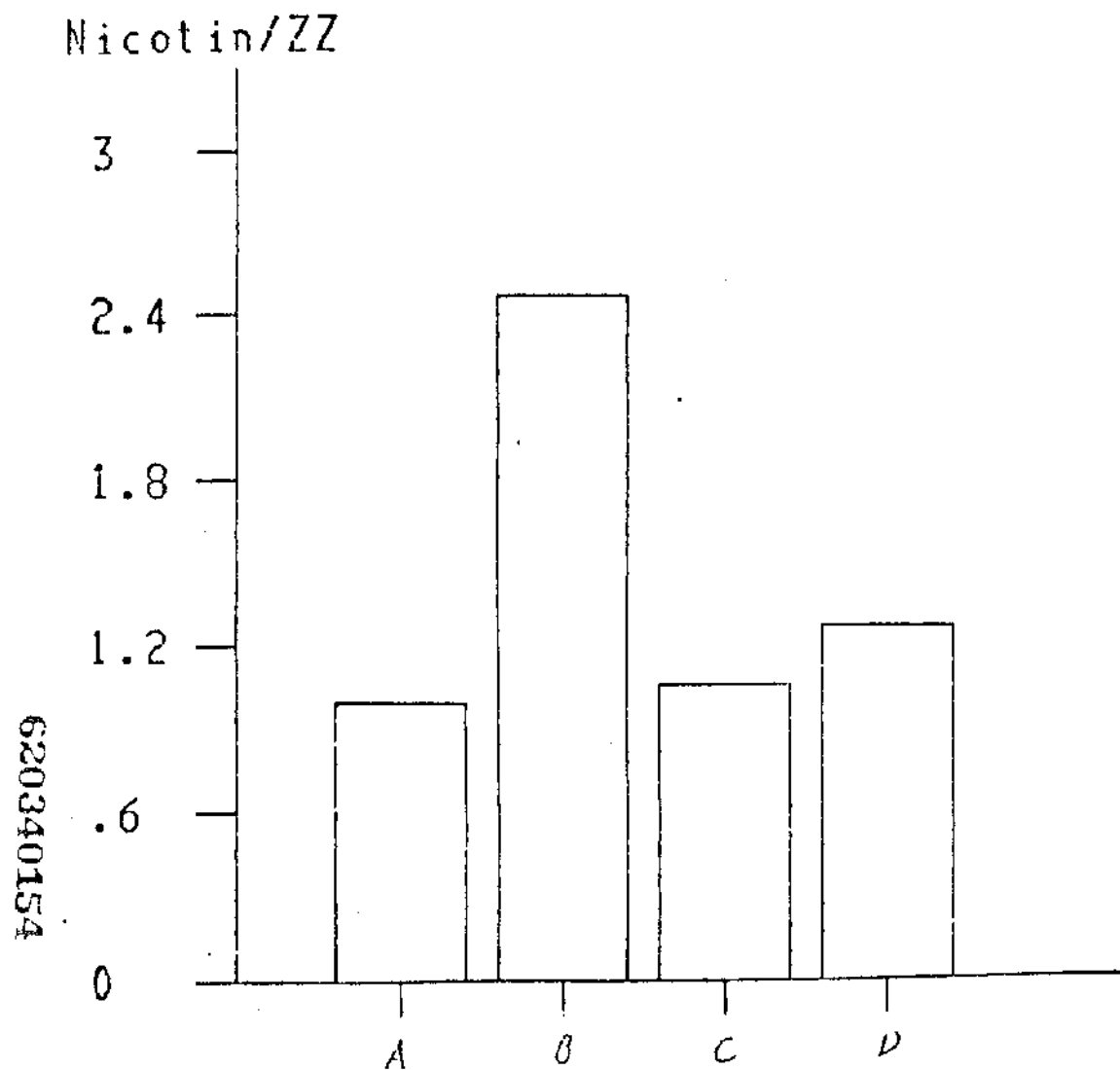
slide 11

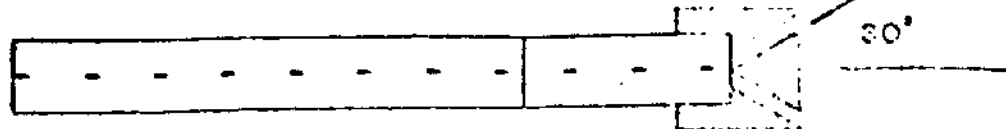
sample	strength rating	TPM (DIN) mg	TPM puff number, [mg]	E $\left[\frac{\text{mg} \cdot 10^2}{\text{ml}} \right]$
A	-	1.6	0.21	1.4
B	stronger	1.4	0.15	2.1

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Öffnungswinkel 30° , divergent,
Lochdurchmesser 2 mm

2 Lochanordnung



3 Lochanordnung



4 Lochanordnung



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Sensorische Einstufung

mouthfull feeling : 1 —————→ 5

Orientierung :



Impact : 5 ←———— 1

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