



BSI Standards Publication

# Safety of toys — Children's mouthing behaviour in contact with toys

**National foreword**

This Published Document is the UK implementation of CEN/TR 16918:2015.

The UK participation in its preparation was entrusted to Technical Committee CW/15/5, Toys - Chemical.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

© The British Standards Institution 2015. Published by BSI Standards Limited 2015

ISBN 978 0 580 91085 2

ICS 97.200.50

**Compliance with a British Standard cannot confer immunity from legal obligations.**

This Published Document was published under the authority of the Standards Policy and Strategy Committee on 31 December 2015.

**Amendments issued since publication**

Date	Text affected
------	---------------

---

TECHNICAL REPORT

**CEN/TR 16918**

RAPPORT TECHNIQUE

TECHNISCHER BERICHT

December 2015

ICS 97.200.50

English Version

## Safety of toys - Children's mouthing behaviour in contact with toys

Sécurité des jouets - Analyse de la mise à la bouche des  
jouets par les enfantsSicherheit von Spielzeug - Mundkontaktverhalten von  
Kindern

This Technical Report was approved by CEN on 7 December 2015. It has been drawn up by the Technical Committee CEN/TC 52.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.



EUROPEAN COMMITTEE FOR STANDARDIZATION  
COMITÉ EUROPÉEN DE NORMALISATION  
EUROPÄISCHES KOMITEE FÜR NORMUNG

**CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels**

<b>Contents</b>		Page
European foreword.....		5
Introduction .....		6
1	Scope .....	7
2	Literature review .....	7
2.1	General.....	7
2.2	Methodological review on children’s mouthing behaviour.....	8
2.3	Main results on the duration and frequency of children’s mouthing behaviour in previous literature .....	11
2.3.1	General.....	11
2.3.2	Daily time available to mouth not spent sleeping or eating.....	12
2.3.3	Frequency of mouthing objects.....	13
2.3.4	Amount of the time spent mouthing objects .....	14
3	Design of the research .....	16
3.1	General objective.....	16
3.2	Data collection.....	16
3.3	Methodology .....	17
3.3.1	General.....	17
3.3.2	Ethnographic.....	18
3.3.3	Home environment.....	18
3.3.4	Free play environment.....	20
3.3.5	Pilot test.....	21
3.3.6	Observational tool and protocols.....	22
3.3.7	Training sessions .....	23
3.4	Sample description: Children and toys .....	23
3.4.1	General.....	23
3.4.2	Children sample.....	24
3.4.3	Sample.....	31
3.5	Statistical analysis .....	35
4	Results of children’s mouthing behaviour in contact with toys .....	36
4.1	Frequency children mouthed toys .....	36
4.1.1	General.....	36
4.1.2	By age.....	36
4.1.3	By gender .....	37
4.1.4	By gender and age .....	38
4.1.5	By country.....	39
4.1.6	By country and age .....	40
4.2	Time children spent mouthing toys .....	41
4.2.1	General.....	41
4.2.2	By age.....	41
4.2.3	By gender .....	42
4.2.4	By gender and age .....	42
4.2.5	By country.....	43
4.2.6	By country and age .....	44
4.2.7	Toy-to-mouth contact duration by age.....	45
4.3	Type of mouthing: lip/tongue, suck/engulf, bite/chew .....	47

4.3.1	Frequency by type of mouthing.....	47
4.3.2	Frequency by type of mouthing and age.....	48
4.3.3	Time children spent mouthing, by type of mouthing .....	49
4.3.4	Time children spent mouthing toys by type of mouthing and age.....	50
4.4	Elastomeric vs. not elastomeric material .....	51
4.4.1	General .....	51
4.4.2	Frequency by elastomeric and not elastomeric material .....	51
4.4.3	Frequency by elastomeric and not elastomeric material and age.....	52
4.4.4	Time children spent mouthing by elastomeric and not elastomeric material.....	53
4.4.5	Time children spent mouthing, by elastomeric and not elastomeric material and age .....	53
4.4.6	Toy-to-mouth contact duration by elastomeric and not elastomeric material .....	54
4.4.7	Toy-to-mouth duration by elastomeric and not elastomeric material and age.....	55
4.4.8	Qualitative approach of the influence of elastomeric material in children's mouthing behaviour.....	55
4.5	Toys intended vs not intended to be mouthed.....	58
4.5.1	General .....	58
4.5.2	Frequency children mouthed toys intended vs not intended to be mouthed.....	58
4.5.3	Frequency children mouthed toys intended vs not intended to be mouthed by age.....	59
4.5.4	Time children spent mouthing toys intended vs not intended to be mouthed .....	60
4.5.5	Time children spent mouthing toys intended vs not intended to be mouthed by age .....	60
4.5.6	Toy-to-mouth contact duration for toys intended vs not intended to be mouthed.....	61
4.5.7	Toy-to-mouth contact for toys intended vs not intended to be mouthed by age.....	62
4.6	Toy categories.....	63
4.6.1	General .....	63
4.6.2	Frequency children mouthed toys by toy category .....	64
4.6.3	Time children spent mouthing toys by toy category .....	65
4.7	Bite marks left on toys .....	66
4.8	Degree of salivation .....	67
4.8.1	General .....	67
4.8.2	Toys that contributed to high degrees of salivation .....	68
5	Estimations .....	69
5.1	General .....	69
5.2	Results of ethnographic study.....	69
5.2.1	Time children are awake and not eating.....	69
5.2.2	Time children are in contact with toys .....	71
5.3	Estimation formula .....	72
5.4	Estimation of frequency children mouth toys.....	72
5.4.1	General .....	72
5.4.2	Estimation of frequency children mouth toys by age .....	73
5.5	Estimation of time children spend mouthing toys.....	74
5.5.1	General .....	74
5.5.2	Estimation of time children spend mouthing toys by age.....	75
6	Discussion.....	76
6.1	Frequency children mouthed toys.....	76
6.2	Time children spent mouthing toys.....	77
6.3	Time available to mouth toys per day.....	78
6.4	Type of mouthing.....	80
6.5	Elastomeric toys.....	80
6.6	Toys intended and not intended to be mouthed .....	80
6.7	Mouthing toys by categories .....	80
6.8	Bite marks left on toys .....	81
6.9	Degree of salivation .....	81

<b>7</b>	<b>Summary .....</b>	<b>81</b>
<b>7.1</b>	<b>Introduction .....</b>	<b>81</b>
<b>7.2</b>	<b>Literature review .....</b>	<b>81</b>
<b>7.3</b>	<b>Design of the research .....</b>	<b>82</b>
<b>7.4</b>	<b>Results.....</b>	<b>82</b>
<b>7.4.1</b>	<b>Frequency children mouthed toys.....</b>	<b>82</b>
<b>7.4.2</b>	<b>Time spent mouthing toys .....</b>	<b>82</b>
<b>7.5</b>	<b>Estimations.....</b>	<b>83</b>
<b>7.5.1</b>	<b>The frequency children mouthed toys .....</b>	<b>83</b>
<b>7.5.2</b>	<b>Time spent mouthing toys .....</b>	<b>83</b>
<b>7.6</b>	<b>Childcare articles .....</b>	<b>83</b>
<b>Annex A (informative)</b>	<b>Summary of previous quantitative studies on children’s mouthing behaviour .....</b>	<b>84</b>
<b>Annex B (informative)</b>	<b>Results of children’s mouthing behaviour in contact with childcare articles.....</b>	<b>92</b>
<b>B.1</b>	<b>Introduction .....</b>	<b>92</b>
<b>B.2</b>	<b>Design of the research .....</b>	<b>92</b>
<b>B.3</b>	<b>Frequency children mouthed childcare articles.....</b>	<b>96</b>
<b>B.4</b>	<b>Time children spent mouthing childcare articles .....</b>	<b>98</b>
<b>B.5</b>	<b>Type of mouthing lip/tongue, suck/engulf, bite/chew .....</b>	<b>102</b>
<b>B.6</b>	<b>Childcare article category .....</b>	<b>105</b>
<b>B.7</b>	<b>Summary .....</b>	<b>105</b>
<b>Annex C (informative)</b>	<b>Statistical results.....</b>	<b>107</b>
<b>C.1</b>	<b>Normal distribution test.....</b>	<b>107</b>
<b>C.2</b>	<b>Significance test.....</b>	<b>109</b>
<b>C.3</b>	<b>Mean weighted by year .....</b>	<b>123</b>
<b>C.4</b>	<b>Observational periods.....</b>	<b>128</b>
<b>Annex D (informative)</b>	<b>Glossary of terms and definitions.....</b>	<b>130</b>
<b>Bibliography.....</b>		<b>132</b>

## **European foreword**

This document (CEN/TR 16918:2015) has been prepared by Technical Committee CEN/TC 52 “Safety of toys”, the secretariat of which is held by DS.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

## Introduction

This CEN Technical Report presents the results of a European Study on “Children's mouthing behaviour in contact with toys”. The objective of the study was the measurement and quantification of the duration and frequency that children under 36 months introduce toys into their mouths spontaneously.

It presents information about the literature review focused on children's mouthing behaviour, including commonly used methodologies in addition to a review of significant results from previous research. It also includes the design of the research; methodology; data on the children and toy sample; complete results obtained in the frequency and duration that children mouthed toys and estimated data on the time children under 36 months spend mouthing toys each day.

Up to now, the study was the one with the largest sample (245 children and a total number of 1 680 observations) and the only one to be carried out in three different European countries (Germany, France and Spain). It was also the study with the highest representation of specific toys (54 different products) for children up to 36 months.

In addition to the results on the mouthing behaviour with regard to toys, Annex B contains information concerning children's mouthing behaviour in contact with childcare articles. This informative annex is, however, just a first approach, and of limited value.

Clause 7 of this CEN Technical Report contains a more detailed summary of the results of the European Study on “Children's mouthing behaviour in contact with toys”.



## 1 Scope

This Technical Report presents the results of a European Study on “Children's mouthing behaviour in contact with toys”. It provides statistical data on the duration and frequency that children under 36 months introduce toys into their mouths and estimated data on the time children under 36 months spend mouthing toys each day.

Furthermore, it provides information on:

- the literature focused on children's mouthing behaviour, including commonly used methodologies and significant results;
- the design and methodology of the study;
- the data on the children and toy sample;
- the forms used in data collection.

## 2 Literature review

### 2.1 General

Mouthing is an important component in childhood development. In early development, sucking provides essential nutrients in the form of breast or bottle-feeding, as well as a feeling of well-being and a sense of security (Juberg et al., 2001 [1]). If infants are not allowed unrestricted breast-feeding, they will suck on a dummy, thumb (or other fingers), blanket, or toy (Groot et al., 1998 [2]). As children develop, mouthing behaviour, in combination with looking and touching, allows children to explore and investigate their environment. Mouthing behaviour develops into an exploratory behaviour in which objects are placed into the mouth for a few seconds for purposes of discovery. During this stage of development, children will put their hands, and any object that they come in contact with, into their mouths (Ruff, 1984 [3]; Ruff and Dubiner, 1987 [4]; Davis et al., 1995 [5]; Groot et al., 1998 [2]; Tulve et al., 2002 [6]).

In the field of psychology, Freud named the stage between birth and 2 years of age the 'oral stage'. This first stage of development is characterized by the physical aspects of sucking, encompassed by the mouth, tongue and lips. During the oral stage, it is common for children to have a persistent tendency to put whatever falls into their hands into their mouths. It is the means by which they express their need to experience the world through their mouths. The pleasurable activity of sucking, biting and chewing, means the child starts to recognize objects and distinguish them as separate from himself. When a baby puts something in his mouth, he bites it with his gums, sucks it and moves it with his tongue. It is the first form of learning that children experience, as they begin to recognize textures, temperatures and forms through mouthing. Furthermore, it benefits verbalization processes, chewing and teething.

Teething is another reason that children will mouth fingers and objects. At this stage of development, mouthing alleviates the pain and discomfort associated with teething (Groot et al., 1998 [2]). Teething usually begins at 6 months to 8 months, but may start several months earlier or later. Teething continues in babies until approximately the age of 3.

The first teeth to appear are usually the two bottom front teeth, also known as the lower front incisors. Between 4 weeks to 8 weeks later, they are followed by the four upper front teeth. About a month later, the lower lateral incisors appear. Next come the first molars, and then finally the canines. Most children have their 20 milk teeth (which are the first teeth to appear) when they reach three years of age. The commencement of teething is the most important stage in babies' mouthing.

Young children's urge to suck and mouth is a natural developmental phase. Sucking may be divided into two distinct behavioural types: nutritive and non-nutritive sucking (Turgeon-O'Brien et al., 1995 [7]).