

The Director General

Maisons-Alfort, 13th July 2011

OPINION **of the French Agency for Food, Environmental and Occupational** **Health & Safety**

on the use of 3D game consoles

ANSES undertakes independent and pluralistic scientific expert assessments.

ANSES primarily ensures environmental, occupational and food safety as well as assessing the potential health risks they may entail.

It also contributes to the protection of the health and welfare of animals, the protection of plant health and the evaluation of the nutritional characteristics of food.

It provides the competent authorities with all necessary information concerning these risks as well as the requisite expertise and scientific and technical support for drafting legislative and statutory provisions and implementing risk management strategies (Article L.1313-1 of the French Public Health Code).

Its opinions are made public.

1. SUBJECT OF THE REQUEST

On Thursday 27 January 2011, the French Agency for Food, Environmental and Occupational Health & Safety received a request from the consumer-defence association “Robin des Bois” for an expert appraisal and opinion concerning the use of the Nintendo 3DS game console.

In its written request, “Robin des Bois” stated that it was unaware of any available scientific data on the effect on health, and especially the effect on eyesight, of family use of this game console in the home. It indicated that there are accounts of risk to those suffering from such conditions as strabismus as well as a risk of eye strain, stinging eyes, migraines and nausea. The association also mentions that the manufacturer, Nintendo, issued a warning in parallel with the launch campaign for its Nintendo 3DS game console indicating a risk of damage to the eyesight of children aged six and under. The association also points out that, in certain cases (school holidays, hospital stays, etc.), children and other population groups may be subject to particularly intense exposure to game consoles.

ANSES acknowledged receipt of the request from the association on 9 February 2011. A meeting with the Association was held on 18 March 2011 to clarify its expectations. During this meeting, ANSES and the association “Robin des Bois” observed that concerns about potential health effects related to the use of the “Nintendo 3DS” console opened up a much broader issue, covering all technologies designed to provide a three-dimensional audiovisual experience.

However, in order to respond promptly to the question raised by “Robin des Bois”, ANSES is publishing this Opinion containing its initial conclusions and recommendations with respect to 3D game consoles.

2. BACKGROUND TO THE REQUEST

In the last few years there has been very rapid development of new 3D audiovisual technologies. With the sharp rise in the number of 3D feature films in cinemas since the mid-2000s, 3D technology is now spreading to televisions, home game consoles and mobile phones.

Television manufacturers have been working on products allowing programmes (films, sporting and cultural events, etc.) to be viewed in three dimensions via different methods, some of which require the use of special glasses. More recently, in March 2011, Nintendo launched its “Nintendo 3DS” game console on the European market, which for the first time allows players to perceive images in 3D without wearing special glasses.

However, the development of these 3D technologies raises the question of their impact on eyesight. Nintendo issued a health warning when marketing its new console, repeated on the outside of the package:

“The use of the 3D feature by children aged six and under may cause vision damage. Therefore it is recommended that:

- only children over six should use the system in 3D mode;
- if children aged six and under have access to the system, parents or legal guardians should restrict the display of 3D images using the Parental Controls feature.”

It is the development of these applications, which can be used by the very young, together with the health warnings recommending restricting the use of these consoles to children over the age of six, that alerted “Robin des Bois” as a consumer-defence association to issue its request asking ANSES to study the scientific data available on the subject.

3. ORGANISATION OF THE EXPERT APPRAISAL

The Agency studied the existing literature as thoroughly as possible. The scientific studies chosen for analysis had been published in international peer-reviewed journals.

Although the goal of this study was not to produce a quantitative risk assessment, which would not be possible because of the limited data available (no data concerning a “dose-response” relationship, few quantified exposure data, etc.), the work was carried out as a normal scientific assessment of the risks to health.

An analysis of the available literature was submitted to expert rapporteurs selected for their competence in ophthalmology, orthoptics (vision therapy) and the cognitive sciences. The work was also submitted to the ANSES Expert Committee (CES) for “Assessment of the risks related to physical agents, new technologies and development areas”.

In addition, on 18 May 2011 the Agency and its expert rapporteurs interviewed Nintendo and asked its representatives to present the scientific evidence on which it had based its health warnings concerning the use of the “Nintendo 3DS” game console. During the hearing, Nintendo supplied complete documentation on the warnings concerning the use of this console, together with the scientific articles on which it had based the risk assessment underlying its warning.

This Opinion is therefore based on a detailed analysis of the available scientific literature, with comments by the expert rapporteurs and the experts of the CES for “Assessment of the risks related to physical agents, new technologies and development areas”.

This expert appraisal was carried out in accordance with the French Standard NF X 50-110 “Quality in expertise activities (May 2003)”.

4. ANALYSIS

The assessment carried out by the Agency and its experts in response to the question raised by “Robin des Bois” concerns the physiological aspects of three-dimensional vision, the technical characteristics of the 3D game consoles and the potential health effects, via studies of susceptible population groups and the visual development of children.

Perception of space in 3 dimensions

The perception of space in 3 dimensions involves a range of factors. One of the most important factors is stereoscopic vision, i.e. the perception of depth and distance of an object resulting from an overlap between the visual fields of the two eyes. As the eyes are placed at an average distance of 65 mm one from another in adults, each eye perceives the object from a slightly different angle, which produces two different retina images. The brain exploits this difference by merging the two images to perceive the object in three dimensions.

The quality of stereoscopic vision is influenced by a considerable number of individual characteristics: pupillary distance, convergence, pupil diameter, the “accommodation-convergence” ratio¹, age, etc. Furthermore, a considerable proportion of the population has deficient stereoscopic vision, some people having none at all. A report by the French National Authority for Health² (2002) estimates that as many as 14% of the population under the age of 6 years could suffer from varying degrees of amblyopia³, accompanied by deficient stereoscopic binocular vision.

¹ To assess the relationship between accommodation and convergence in an individual, the “accommodation-convergence” (AC/A) ratio is calculated, giving the degree of accommodative convergence for an accommodation (measured in diopters).

² “Early vision screening in children to prevent amblyopia”, ANAES, October 2002

³ Amblyopia: lost or insufficiently developed vision, usually affecting a single eye. Caused by physical limitations on the eye or the effects of these limitations on the nerves linking the eye to the brain.

The 3D technology used in the Nintendo 3DS game console

The Nintendo 3DS game console uses the technology known as a parallax barrier. This is an auto-stereoscopic technology, i.e. one that gives 3D vision without having recourse to special glasses. A fixed mask with several lateral slits is placed in front of an LCD (Liquid Crystal Display) screen to act as a barrier, with the result that each eye receives a different image. The screen thus displays different bands of image for each eye. An optimum view of the 3D image is only obtained if the observer is positioned opposite the centre of the screen.

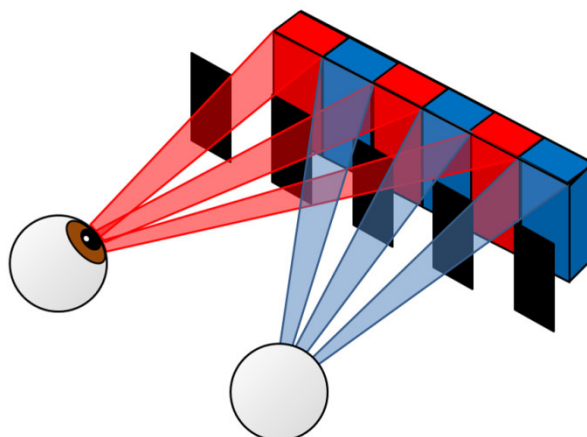


Figure 1: Principle of auto-stereoscopic technology using a parallax barrier

Potential health effects

No scientific studies have as yet specifically investigated the health effects of 3D game consoles. There have, however, been a few studies on limited population samples where the participants were exposed to different 3D audiovisual technologies. These pioneering experiments, often carried out with groups of young people (adolescents and young adults), provide a way of evaluating the visual comfort of observers, either with objective physiological measurements or with subjective questionnaires completed by the participants. These studies are a first step towards characterising the health effects of 3D technologies. One of their aims is to determine the parameters for a precise assessment of the observer's visual comfort. It would appear that onset of visual fatigue occurs more rapidly and more intensely when viewing 3D images than when viewing 2D images, but this requires confirmation. The symptoms of visual fatigue can be divided into four categories: asthenopia (eye strain), stinging eyes, disturbed vision (e.g. double vision) and extra-ocular symptoms (headaches, muscular pain, nausea, etc.).

However, there is currently little information available concerning the health effects or the likely exposure of the population with which to assess the potential health effects of 3D game consoles.

Susceptible population groups

There has not as yet been any study specifically investigating the health effects of 3D game consoles from which to identify susceptible population groups. Nonetheless, it is

possible to predict from a study of the scientific literature concerning virtual 3D environments that at least two types of susceptible population are likely to emerge:

- young children, whose stereoscopic vision is still developing;
- individuals suffering from binocular disparity (heterophoria⁴, insufficient convergence, etc.). The latter account for a significant proportion of the population, most often undiagnosed and unaware of their deficiency.

The visual development of children

All the published work investigating the visual development of children concurred in stating that there are several phases of development of the visual system. It remains difficult to define the exact ages at which these phases occur, however. Some studies suggest that the phase during which the visual system is at its most plastic occurs before the age of two years, with a second critical period lasting at least until six years of age and probably until eight years of age. However, these age limits vary depending on the children and the terrain (pre-mature birth, for example). It would therefore seem that these are the periods during which the child's visual system is at its most vulnerable.

A small number of studies investigated the potential dangers of exposure to 3D displays during childhood and put forward some critical ages. Rushton and Riddell⁵, especially, examined the scientific literature concerning the development of eyesight in children and the possible effects on eyesight of viewing 3D images. They concluded that the visual system of children continues to develop until at least the age of seven.

5. THE AGENCY'S CONCLUSION AND RECOMMENDATIONS

Concerning the use of 3D game consoles

Considering:

- the lack of available data to date on the potential health effects of 3D game consoles;
- the difficulty of determining the age at which the visual system can be considered to be mature. Current estimates of the age at which the visual system attains maturity vary from 6 to 10 years;

ANSES considers that it is not possible:

- to reach any conclusions on the health risks concerning the use of 3D game consoles;
- to determine an exact age limit after which exposure to the 3D images of game consoles would not affect the visual development of children.

However, when the following is taken into consideration:

- that certain scientific studies suggest that when viewing 3D images eye strain occurs more rapidly and more intensely than when viewing 2D images;
- that 3D technologies are constantly evolving and that 3D audiovisual equipment, especially for use in the home, is becoming more widespread;

⁴ Heterophoria: tendency to squint

⁵ Rushton and Riddell, 1999, Developing visual systems and exposure to virtual reality and stereo displays: Some concerns and speculations about the demands on accommodation and vergence. Applied Ergonomics, 30 (1): 69-78

- that these technologies are often accessible to children whose visual system is still developing;
- that the population groups susceptible to exposure to these different 3D technologies are wide-ranging (children, general population, workers, etc.);

the Agency wishes to emphasise that a certain number of vulnerability indicators designate children as a susceptible population for a range of symptoms associated with viewing 3D images.

The Agency therefore plans on its own initiative to undertake an appraisal of the health risks related to all 3D audiovisual technologies.

The Director General

Marc MORTUREUX

KEYWORDS

Keywords:

3D, GAME CONSOLE, VISUAL DEVELOPMENT, CHILDREN

ANNEX: Text of the request

[Translation – a copy of the original document appears on the next page.]

27 January 2011

Dear Director General,

Please find below a request for an expert appraisal and opinion by ANSES concerning the use of game consoles. We should be much obliged if you would inform of us of your intentions regarding our request.

Best regards,

Jackie Bonnemains
President of “Robin des Bois”

Request for Expert Appraisal

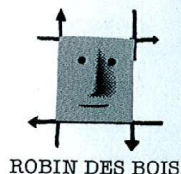
The association “Robin de Bois” accredited as an association for the protection of the environment, requests that ANSES issue an opinion concerning the use of the Nintendo 3D game console, whose distribution on the market in Europe has been set for 25 March 2011.

Just a few weeks before this large-scale sales campaign, there seem to be no scientific data on the effects on health, and especially on eyesight, of the family use of this game console in the home. Certain authorities have suggested that there may be a risk to subjects suffering from strabismus and, more generally, specialists in the field of ophthalmology mention the risk of eye strain, stinging eyes, headaches/migraines and nausea. We feel that these consequences for health, whose cumulative effects could potentially affect functions other than eyesight, need investigation.

Nintendo, the manufacturer, has also issued a health warning in parallel with its marketing campaign, the text of which is attached to this request. It mentions the risk of eyesight disorders for children 6 years old or under. It is worth noting that users could well become “immersed” for long periods at certain times, depending on school holidays and other factors (including immobilisation for health reasons) that can lead children or other groups to turn to video games.

In a separate letter we have asked the manufacturer to supply us with the documents on which it based its recommendations, and which led it to set the threshold at the age of six.

le 27 janvier 2011



ROBIN DES BOIS

2011-SA-0025

COURRIER DG

DATE: 28 JAN. 2011

N° COURRIER 11-0145

Monsieur le Directeur Général,

Nous vous prions de trouver ci-dessous une demande d'expertise et d'avis de l'ANSES concernant l'utilisation d'une console de jeux. Nous vous prions de nous faire connaître la suite que vous entendez réserver à cette saisine.

Avec mes meilleurs sentiments.

Jacky Bonnemains,
Président de l'association Robin des Bois.

Demande d'expertise :

L'association Robin des Bois agréée au titre de la protection de l'Environnement souhaite recueillir l'avis de l'ANSES au sujet de l'utilisation de la console Nintendo 3D dont la date de diffusion en Europe est prévue le 25 mars 2011.

Il ne semble pas exister quelques semaines avant cette commercialisation à grande échelle de données scientifiques sur les effets sur la santé et en particulier sur la santé oculaire de l'usage domestique et familial de cette console de jeux. Des voix autorisées évoquent des risques pour les porteurs de pathologies comme le strabisme et plus généralement les spécialistes en ophtalmologie évoquent la fatigabilité, les picotements, les migraines ou les nausées, autant de conséquences sanitaires dont les effets cumulatifs et susceptibles d'atteindre d'autres fonctions que la perception visuelle nous paraissent devoir être examinés.

Le fabricant Nintendo accompagne le plan de lancement de cette console de jeux d'un avertissement mis en annexe de cette saisine – les risques d'endommagement de la vue sont mentionnés pour les enfants de 6 ans et moins. Il est à noter par ailleurs que « l'immersion », selon le terme consacré, pourrait être longue dans certaines circonstances liées aux vacances scolaires ou aux différents facteurs y compris sanitaires amenant les enfants ou d'autres cohortes à une disponibilité particulière.

Nous avons demandé au fabricant par courrier séparé de bien vouloir nous faire parvenir les documents qui l'amènent à émettre cette recommandation et à la fixer au seuil de 6 ans.

Association de protection de l'Homme et de l'environnement
Depuis 1985 / Since 1985

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