



DOCTORATE IN CLINICAL PSYCHOLOGY

Literature Review

Maternal Sensitivity and Child Behaviour: A Literature Review

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A handwritten signature in black ink, appearing to be "P. R. S.", is written on a light grey rectangular background.

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Abstract

Purpose: This review presents and examines the literature about the association between Maternal Sensitivity (MS) and child behavioural difficulties and highlights future directions.

Background: MS has been associated with child development in a number of areas such as cognitive, social and behavioural development. Associations between lower MS and negative child outcomes as well as higher MS and positive child outcomes have been found. This review specifically examines the evidence for an association of MS with child behavioural difficulties as previous literature has indicated an association in this area as well as clear negative consequences of childhood behavioural difficulties on later child development. **Results:** 33 relevant studies were identified and discussed. Particular focus was given to eight large longitudinal studies with population samples, which found varied results in relation to an association between MS and child behaviour. Additionally, all of these studies used samples from the United States. Effects of child characteristics such as gender and temperament and maternal characteristics on the association were found. **Conclusions:** Given the long-term consequences of early childhood difficulties and the varied outcomes of the most relevant studies, further UK-based longitudinal research exploring the association between MS and child behaviour, whilst controlling for the effects of both maternal and child characteristics, are required to add to this vital area of research.

Keywords: Maternal Sensitivity, Maternal Responsiveness, Child Behaviour, ALSPAC

Introduction

This review aims to critically examine the literature concerning the relationship between maternal sensitivity (MS) and child behaviour. The review will particularly focus on longitudinal, population based research and highlight gaps in the literature that may be explored in future research.

MS is a concept which has been researched intensively over the last decades and which is thought to have a crucial influence on child development. The term MS was first introduced in the 1970s by Mary Ainsworth as part of her theories of attachment (Ainsworth, Blehar, Waters & Wall, 1978) and describes a mother's ability to accurately perceive and interpret her infant's verbal and non-verbal communications and respond in an age-appropriate fashion. MS is believed to be one of the central mechanisms that influence the quality of the mother-child attachment relationship and research has shown that high MS is associated with a more secure attachment style (Belsky & Fearon, 2002).

Whilst the concept of MS has been used in many studies, some researchers have stated that its content can be confusing and it is unclear which maternal behaviours are incorporated in it (e.g. Meins, Fernyhough, Fradley & Tuckey, 2001). Furthermore MS is used interchangeably with the term Maternal Responsiveness in some literature whilst other researchers consider responsiveness a part of MS (Bohlin, Hagekull, Germer, Andersson & Lindberg, 1989). In their concept analysis of MS, Shin and colleagues (2008) endeavored to derive a complete description of the concept of MS and concluded that MS incorporates four critical attributes, including a dynamic process involving maternal abilities, a reciprocal give-and-take with the infant, contingency on the infant's behaviour and the quality of maternal behaviours. They furthermore found that a number of factors have been identified which have shown to have an effect on MS. Factors which have a positive influence on MS included maternal social support, self esteem and attachment; whilst negative factors included maternal depression, stress and anxiety. In addition child characteristics such as child gender, temperament and health have been found to have an effect on MS.

Despite some of the difficulties in definition research on the consequences of MS has been extensive and has found associations with children's cognitive, social and behavioural development (e.g. Landry, Smith & Swank, 2006; Bornstein & Tamis-LeMonda, 1989; Eshel, Daelman, de Mello & Martines, 2006). These findings are in line with many other findings in

developmental research which emphasises the importance of early experience on later development. A lack of early MS has been associated with children's maladjustment and a variety of negative outcomes for children (Kemppinen, 2007; NICHD, 1998). Furthermore, research has shown that early childhood problems are strongly predictive of later psychopathology (Campbell, 2002).

The effect of MS on child behavioural outcomes is a particular focus of developmental research. Behavioural difficulties in children of any age are an important focus of research due to the long-term implications these difficulties have (Campbell, 2002). The pre-school years have been identified as an important period for children's behavioural development and can determine whether children progress on an adaptive or maladaptive developmental path into adolescence (Campbell & Ewing, 1990). Prospective evidence increasingly shows that behavioural difficulties developed in the pre-school years can continue into adolescent years and often intensify (Moffitt, 1990). Behavioural difficulties in middle and later childhood furthermore have a significantly detrimental effect on other areas of development such as cognitive and social competence (McGee, Partridge, Williams & Silva, 1991; Olson 1992). This evidence shows that research into the predictors of behavioural maladjustment in early childhood is crucial. Identifying and examining the important mechanisms of positive behavioural adjustment, such as MS, therefore has wide reaching implications for families and professionals as well as policy development.

Method

Identification of Relevant Studies. A literature search was conducted using PubMed, Web of Science and PsychINFO databases. Keyword searches were carried out in all three databases using the terms "Maternal Sensitivity" OR "Maternal Responsiveness" AND "Child Behaviour/Behavior". Index searches were also carried out in the PubMed database using the MeSH terms for "Maternal Behaviour" AND "Child Behaviour". Table 1 summarises the searches carried out and outlines the number of initial results obtained for each search. In order to detect papers not identified by the search, reference lists in identified articles were also searched.

Table 1: Database searches

Database and search terms	Number of results
PubMed (Maternal Sensitivity OR Maternal Responsiveness AND Child Behaviour)	683
Web of Science (Maternal Sensitivity OR Maternal Responsiveness AND Child Behaviour)	575
PsychINFO (Maternal Sensitivity OR Maternal Responsiveness AND Child Behaviour)	273
PubMed (MeSH terms for Maternal Behaviour AND Child Behaviour)	387

Inclusion and Exclusion Criteria. Limitations applied to all searches included a focus on papers in the English language, published after 1980 due to the majority of relevant papers being published after this date. Titles and abstracts of all papers found through the searches were scanned and those that fell outside the topic of interest were eliminated. Papers which focussed on intervention in the area of MS were eliminated due to the volume of relevant research and only studies which focussed on the baseline measurement of MS and the associations on child behaviour were included.

Organisation of the Review. The search yielded 33 relevant papers. Due to the predictive power of large (>104) longitudinal, population-based designs a particular focus was placed on studies which adhered to these criteria. Eight studies met these criteria and are examined in greater detail at the start of the review. Longitudinal studies which included a small population sample ($n \leq 104$) are examined next (3), followed by cross-sectional studies which used a population sample (7). Finally the papers which used a variety of risk samples are examined (15).

The review therefore examines the findings of the relevant literature and appraises the study designs which were employed. Furthermore an evaluation of the various measures is provided.

Conceptual and Definition Problems

Maternal Sensitivity. As mentioned above the term MS has been used interchangeably with a number of terms, including maternal responsiveness. Despite the variety of terms used, the maternal behaviours described generally refer to a mother's ability to perceive and interpret her infant's signals accurately and respond appropriately (Ainsworth, 1978). Some of the studies examined in this review have used descriptions such as positive parenting or caregiving to describe a range of similar behaviours. For the purpose of this review these behaviour clusters will be broadly described as MS.

Child Behaviour. The term child behaviour broadly describes all acts which a young person between birth and the age of 18 engages in. This review is focussing mainly on the occurrence of behavioural difficulties in young children. These behaviours include both internalising and externalising behaviours as well as issues of social and emotional development. Behavioural assessments generally distinguish between certain clusters of behaviours such as emotional symptoms, conduct problems, hyperactivity-inattention and peer problems (Muris, Meesters & van den Berg, 2003).

Main Review

Longitudinal studies with large population samples. Large longitudinal studies using non-clinical samples have found a number of positive associations between MS and children's behaviour, however not all of these studies found clear evidence of an association. The NICHD Early Childcare Research Network (1998), using a sample of 1041 two-year-old children, found that family factors such as sensitive mothering were more strongly predictive on child behaviour than child-care factors. Results from maternal reports found that the children of sensitive mothers exhibited fewer behaviour problems and were more compliant at three years of age. Caregiver reports also showed that more sensitive mothers had children who had fewer behavioural difficulties, were more socially competent and showed less negative affect. In a study of 376 children from a subsample of the NICHD study Leerkes, Blankson and O'Brien (2009) found similar associations for MS to distress. Increased MS to distress, but not non-

distress, at six months predicted fewer behaviour problems and increased social competence in 3-year-olds. The study controlled for the effects of infant temperament and found that the effect of MS to distress was particularly positive for infants who were more temperamentally reactive. In a further subsample (n=1081) of the NICHD study Campbell and colleagues (Campbell, Spieker, Vandergrift, Belsky & Burchinal, 2010) found that lower MS during early childhood (six to 54 months) was associated with higher aggression in the children from first through to sixth grade, however these results were only found for girls. Colman, Hardy, Albert, Raffaelli and Crockett (2006) found that increased levels of maternal warmth and decreased levels of punitive behaviours predicted higher levels of self-regulation in a sample of 549 children. It is important to note that the children in this longitudinal study were assessed at the ages of 4/5 and 8/9 years which is considerably older than the previously outlined studies. These associations were still present after controlling for early self-regulation in the children, indicating an effect of maternal behaviour irrespective of the child's early behaviour. A further study investigating externalising behaviours in a sample of 1017 5th graders (Bradley & Corwyn, 2007) found that increased MS, measured at various time-points between one and 54 months, predicted lower levels of externalising behaviours and increased maternal harshness predicted higher levels of externalising behaviours. This study also found that children's levels of self control mediated the effects of parenting on behaviour, indicating an influence of the child's characteristics. The same authors with colleagues Burchinal, McAdoo and Coll (2001), in a large study of children studied between birth and 13 years, found a small effect of parental responsiveness on early social development. An association was also found between parental responsiveness and behavioural difficulties, however this was only found for African-American children from poorer backgrounds. A study carried out by Degnan, Calkins, Keane and Hill-Sonderlund (2008) found that increased maternal control, which is defined as a lack of sensitive parenting, and an increase in punitive parenting predicted increased behavioural difficulties as well as high frustration reactivity in a sample of 318 children assessed at two, four and five years of age. Considering that this study only looked at maternal control as an indicator for lack of MS, comparisons to other studies are difficult. Finally, Blandon, Calkins and Keane (2010), in a study of 253 children, looked at maternal parenting behaviours, toddler risk and social-emotional competence and did not find an association between maternal parenting behaviours at two years of age and toddler competence at five years.

The longitudinal studies described are particularly powerful due to a decreased likelihood of retrospective recall bias. Furthermore longitudinal designs are more able than other designs to detect cause and effect and change over time (Rajulton, 2001) and the likelihood of reverse causality is significantly decreased. Overall, the studies investigated a variety of behaviours associated with MS and assessed a further variety of different behavioural difficulties. Direct comparisons are therefore difficult. This discrepancy appears common in this area, as discussed above. Generally an association between maternal behaviours relating to MS and child behaviour is indicated, both in relation to a lack of MS and the occurrence of a variety of maladjusted behaviours as well as in relation to increased MS and positive behavioural outcomes. However not all studies found a clear association. Some studies found associations only for certain subgroups or certain conditions, such as MS to distress, others did not find an association. So whilst the above studies indicate an association between MS and child behaviour, their variability both in focus and in results makes a clear conclusion difficult.

All of the above studies controlled for a number of known confounding factors such as socioeconomic status (SES), ethnicity, child temperament and gender. All but one study (Degnan et al, 2008) also controlled for the effects of maternal depression, age at birth, education, employment status, household composition, paternal presence and child care. The impact of these variables varied across the studies, although most associations remained after controlling for confounding factors. Finally it is important to note that all of the above described eight studies were carried out in North America and five of these used a variety of data from the NICHD study. It is therefore felt that, apart from a need to clarify the varied results, there is a gap for large longitudinal studies in the area of MS and child behaviour in the United Kingdom which are able to control for a variety of confounding variables.

Longitudinal studies with small population samples. Mantymaa, Puura, Luoma, Salmelin and Tamminen (2004), in a study of 50 mother-infant pairs, found that increased maternal hostility was associated with total behavioural problem scores. In addition, a study of 104 children, looking at the effects of both parenting and early temperament (Rubin, Burgess, Dwyer and Hastings, 2003), found that high levels of maternal negativity predicted a development from aggressive behaviour at age two to externalising behaviours at age four. The authors concluded that externalising problems at age four were a function of the child's

temperament and the parenting styles. In a study looking at similar variables Pettit and Bates (1989) found that low levels of positive maternal interaction predicted increased behavioural difficulties in a sample of 29 children. This study also found that difficult child temperament in conjunction with low maternal involvement was associated with child behavioural difficulties. In sum, these studies further demonstrated an association between MS and child behaviour. Whilst the validity of this research is again increased by the longitudinal designs, the relatively low to very low sample sizes make a generalisability of the results more difficult. Similar to the studies above an association between early temperament, MS and child behaviour warrants further examination due to the indication of child effects on mother-child interactions.

Cross-sectional studies with population samples. Page, Wilhelm, Gamble and Card (2010) in a study of 6377 mother-infant dyads found that increased MS was associated with children's positive social-emotional development, however a similarly strong association was found for the mothers' verbal simulation. It is important to note that children who displayed no distress during the observation were removed from the analysis. Denham (1993) also looked at social-emotional development and found that MR to the child's emotional expression was associated with competence in this area. However, it is important to note that the study included a very small sample of 28 mother-infant dyads. In a study of 102 German infants von Suchodoletz, Trommsdorff and Heikamp (2011) distinguished between two components of positive parenting, namely maternal warmth and responsiveness to distress, and established that whilst increased warmth was associated with an increase in self-regulation abilities, responsiveness to distress was associated with increased internalisation of rules. All results were obtained from self reports and questionnaires however, which limits the validity of these results. Davidov and Grusec (2006) also investigated warmth and responsiveness to distress in a sample of 106 infants and found increased regulation of negative affect in children whose parents were responsive to distress. These results were particularly significant between mothers and sons. Parental warmth was positively related to positive affect regulation and peer acceptance. Again, the study found evidence of effects of temperament on the relationship between parenting and behavioural outcomes. However, the study relied on parental reports for most of the results and used some newly developed measures which require further validation. Furthermore, Georgiou (2008) found that increased MR, as reported by the child and the mother, predicted low scores of bullying behaviour in a sample of Greek 11-year-olds.

Kaufmann, Gesten, Santa-Lucia, Salcedo, Rendina-Gobioff and Gadd (2000), with a sample of 1230 children, found that more authoritative parenting, which is considered to be more sensitive, was associated with less behavioural difficulties in the children. Again, however, these results are only based on report measures. Finally, in a study carried out by Deater-Deckard (2000), with a sample of 120 twin pairs, the author found an association between higher maternal negative affect and higher behavioural difficulties in the child.

In general, when considering the results of the above described studies caution needs to be exercised in relation to the direction of causality due to their cross-sectional designs. Further longitudinal research would need to be carried out to follow up these results. Many of the above studies only relied on maternal reports for both the exposure and outcomes variables which limits validity and confounding variables were not examined consistently. Child temperament and gender were again found to have an effect.

Longitudinal and cross-sectional studies with clinical, risk samples. A number of studies have been carried out looking at the effects of MS on child behaviours in risk samples such as children born pre-term (Bakeman & Brown, 1980; Beckwith, Rodning & Cohen, 1992; Beckwith & Rodning, 1996; Goldberg, Lojkasek, Gartner & Corter, 1989; Goldberg, Corter, Lojkasek & Minde, 1990; Landry, Smith, Swank, Assel & Vellet, 2001 and Laucht, Esser & Schmidt, 2001) which all found an association between MR and child behaviour. All of these studies employed longitudinal designs but varied in sample sizes. Landry and colleagues (2001) measured MR both early and later on and found that a profile of high MR at both stages predicted the most positive behavioural outcomes for children. Children whose mothers were not very responsive at both stages showed the most behavioural difficulties and decreasing responsiveness predicted a decrease in behavioural adjustment. These findings indicate the long-term effect of MR. Further studies with risk groups included children of families with low socio-economic status (Tamis-LeMonda, Briggs & McClowry, 2009; Shaw, Keenan & Vondra, 1994; Shaw & Vondra, 1995; Laucht et al, 2001; Beckwith & Rodning, 1996 and Bakeman & Brown, 1980) and found that increased MR predicted children's lower scores on behavioural measures. Two of these studies found these effects were only significant for boys (Shaw et al, 1994, Shaw & Vondra, 1995). Niccols and Feldman (2006) found a positive correlation between decreased MS and later behavioural difficulties for children with developmental delay. Interestingly, Niccols and colleagues in a later study with children with Down Syndrome (Niccols,

Milligan, Chisholm & Atkinson, 2011) found an association between MS and aggression both at five years, earlier MS, however, did not have an effect on later child behaviour. Kempainen (2007), in a study of at-risk children, also found a positive association between early MS and child cooperation as well as an association between high levels of maternal unresponsiveness and low child cooperation. In a sample of 77 high risk youths with early substance exposure Wakschlag and Hans (1999) found that low MR predicted behavioural problems and disruptive behaviour disorder. Finally, a study conducted in rural India looking at the parenting of malnourished children (Agarwal, Awasthy, Upadhyay, Singh, Kumar & Agarwal, 1991) found positive effects of MR on the children's behavioural and social development.

In sum considering the specific risk samples which these studies investigated generalisations to the wider population cannot be made; however most of the results continue to indicate an association between MS and child behaviour as well as an effect of child gender. There also appears to be a positive effect of ongoing MS as opposed to only early MS.

Review of Measures

Maternal Sensitivity. A variety of measures were used in the above described studies to assess MS and related behaviours. Most studies used observational measures of MS, in the home or laboratory and observed structured play, unstructured play or tasks such as the Strange Situation Task (Ainsworth, Blehar, Waters & Wall, 1978). The Home Observation of the Measurement of the Environment inventory (HOME; Caldwell & Bradley, 1984) was used in a number of studies. Observations were coded in a variety of ways and collapsed into distinct categories. Other measures used were maternal interviews, essays on the topic of parenting style and an extensive variety of self report questionnaires, as outlined in Table 2.

Table 2: Self Report Parenting Measures

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1. The Parenting Style Questionnaire (Baumrind, 1991)
 2. The Engeland MR scales (Engeland, Taraldson & Brunquell, 1977)
 3. The Child-Adult Relational Experimental Index (CARE-Index; Crittenden. 1997)
 4. The Pianta parent-child relationship scale (Pianta, 1995)
 5. The Mother-Child Affect, Responsiveness and Engagement Scale (C-CARES; Tamis-LeMonda, 1999)
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6. The Child Rearing Practices Report Q-Sort (CRPR; Block, 1981)

The diversity of measures reflects both the variety of behaviours assessed and the variety of available measures in this area. The advantage of observational measures is evident in their objectivity compared to a variety of biases which can occur when mothers rate their own parenting quality. Observation methods are therefore recommended for this area of research (Tamis-LeMonda et al, 2009).

Child behaviour. A range of child behaviours were assessed in the above examined studies, using a number of different measures. Observational approaches are used less frequently in this area, despite their increased validity, however a small number of studies used this technique to assess children's behavioural competency, often using specific tasks to evoke behavioural reactions (e.g. the 'high chair task'; Shaw et al, 1994). The most frequently used method of assessment was a variety of questionnaires, the Child Behaviour Checklist (CBCL; Achenbach & Edelbrock, 1983) being the most popular choice as it is a highly valid and reliable measure (Achenbach, 1992). Further assessment scales are outlined in Table 3.

Table 3: Child Behaviour Measures

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1. The Rutter Child Behaviour Scale (Rutter, Tizard, Yule, Graham, & Whitmore, 1976)
 2. The Emotion Regulation Checklist (ERC; Shields & Cicchetti, 1997)
 3. The Strength and Difficulties Questionnaire (SDQ; Goodman, 1997)
 4. The Richman-Graham Behaviour Checklist (Richman & Graham, 1971)

Social Competence

5. The Adaptive Social Behaviour Inventory (ASBI; Hogan, Scott & Bauer, 1992)
 6. The Social Problem-Solving Test (SPST; Rubin, 1981)
 7. The Prosocial Behaviour Questionnaire (PBQ; Weir & Duveen, 1981)
 8. The Pictorial Harter and Pike Scale of Perceived Competence and Social Acceptance (Harter & Pike, 1984)
-

Most often these scales were completed by the mothers, in some of the studies the teachers also completed a measure. Mother's ratings can be very subjective, a further rating by a teacher

or independent carer, possibly combined with some naturalistic observations, is therefore advisable to achieve the most accurate results.

Overview and Future directions. The review has clearly shown that the interest in the area of MS and its effect on child behavioural outcomes is substantial. The results of the above described investigations point towards an association between MS and child behavioural development; however, not all the studies found definite associations. Furthermore, due to the difficulties in definition for both MS and child behaviour outcomes and the variety of different components which both concepts incorporate, exact comparisons are often difficult.

The review concluded that whilst there appears to be a good amount of evidence for an association between MS and child behaviour, not all studies were able to find this association. Also, whilst there has been previous longitudinal work assessing the association between MS and child behaviour, this has been based by and large in North America. Some studies also indicated a confounding effect of child temperament, gender and child characteristics such as self-control on the association between MS and behavioural difficulties, these results warrant further investigation. Particularly the effects of variables which are based within the child have sparked an interest in this area. Tamis-LeMonda et al (2009) raised the question whether more sensitive mothers shape more responsive children, as their study suggested, or whether more responsive children affect their mother's sensitivity or even if there is a reciprocal relationship. These effects need further investigation by including potentially confounding child and maternal variables into the analysis and by using longitudinal designs.

In sum, whilst the area of MS and child behaviour has received significant amounts of interest, further work is needed with UK based longitudinal, population sample designs to create valid and generalisable results for this country and add to the knowledge base in this crucial area. Particular focus should be given to potential confounding variables including maternal and child characteristics. Considering the detrimental effect of less responsive parenting and the further detrimental effects of long-term behavioural difficulties, further results in this area will be highly beneficial.

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Appendix A: Infant Behavior and Development – Instructions for Authors.

PREPARATION OF AN ARTICLE

Use of wordprocessing software

It is important that the file be saved in the native format of the wordprocessor used. The text should be in single-column format. Keep the layout of the text as simple as possible. Most formatting codes will be removed and replaced on processing the article. In particular, do not use the wordprocessor's options to justify text or to hyphenate words. However, do use bold face, italics, subscripts, superscripts etc. When preparing tables, if you are using a table grid, use only one grid for each individual table and not a grid for each row. If no grid is used, use tabs, not spaces, to align columns.

The electronic text should be prepared in a way very similar to that of conventional manuscripts (see also the Guide to Publishing with Elsevier: <http://www.elsevier.com/guidepublication>). Note that source files of figures, tables and text graphics will be required whether or not you embed your figures in the text. See also the section on Electronic artwork.

To avoid unnecessary errors you are strongly advised to use the 'spell-check' and 'grammar-check' functions of your wordprocessor.

Article Structure

Submissions must conform in all respects to the format specified in the *Publication Manual of the American Psychological Association (5th Edition, 1994)*, or they will be returned without review. This requirement applies to the format for tables and figures. Copies of the *Manual* may be ordered from <http://www.apa.org/books/4200061.html> or APA Order Dept., P.O.B. 2710, Hyattsville, MD 20784, USA or APA, 3 Henrietta Street, London, WC3E 8LU, UK.

Subdivision - numbered sections

Divide your article into clearly defined and numbered sections. Subsections should be numbered 1.1 (then 1.1.1, 1.1.2, ...), 1.2, etc. (the abstract is not included in section numbering). Use this numbering also for internal cross-referencing: do not just refer to 'the text'. Any subsection may be given a brief heading. Each heading should appear on its own separate line.

Introduction

State the objectives of the work and provide an adequate background, avoiding a detailed literature survey or a summary of the results.

Material and methods

Provide sufficient detail to allow the work to be reproduced. Methods already published should be indicated by a reference: only relevant modifications should be described.

Theory/calculation

A Theory section should extend, not repeat, the background to the article already dealt with in the Introduction and lay the foundation for further work. In contrast, a Calculation section represents a practical development from a theoretical basis.

Results

Results should be clear and concise.

Discussion

This should explore the significance of the results of the work, not repeat them. A combined Results and Discussion section is often appropriate. Avoid extensive citations and discussion of published literature.

Conclusions

The main conclusions of the study may be presented in a short Conclusions section, which may stand alone or form a subsection of a Discussion or Results and Discussion section.

Appendices

If there is more than one appendix, they should be identified as A, B, etc. Formulae and equations in appendices should be given separate numbering: Eq. (A.1), Eq. (A.2), etc.; in a subsequent appendix, Eq. (B.1) and so on. Similarly for tables and figures: Table A.1; Fig. A.1, etc.

Abstract

A concise and factual abstract is required. The abstract should state briefly the purpose of the research, the principal results and major conclusions. An abstract is often presented separately from the article, so it must be able to stand alone. For this reason, References should be avoided, but if essential, then cite the author(s) and year(s). Also, non-standard or uncommon abbreviations should be avoided, but if essential they must be defined at their first mention in the abstract itself.

Graphical abstract

A Graphical abstract is optional and should summarize the contents of the article in a concise, pictorial form designed to capture the attention of a wide readership online. Authors must provide images that clearly represent the work described in the article. Graphical abstracts should be submitted as a separate file in the online submission system. Image size: Please provide an image with a minimum of 531 × 1328 pixels (h × w) or proportionally more. The image should be readable at a size of 5 × 13 cm using a regular screen resolution of 96 dpi. Preferred file types: TIFF, EPS, PDF or MS Office files. See <http://www.elsevier.com/graphicalabstracts> for examples. Authors can make use of Elsevier's Illustration and Enhancement service to ensure the best presentation of their images also in accordance with all technical requirements: [Illustration Service](#).

Highlights

Highlights are mandatory for this journal. They consist of a short collection of bullet points that convey the core findings of the article and should be submitted in a separate file in the online submission system. Please use 'Highlights' in the file name and include 3 to 5 bullet points (maximum 85 characters, including spaces, per bullet point). See <http://www.elsevier.com/highlights> for examples.

Keywords

Immediately after the abstract, provide a maximum of 6 keywords, using American spelling and avoiding general and plural terms and multiple concepts (avoid, for example, 'and', 'of'). Be sparing with abbreviations: only abbreviations firmly established in the field may be eligible. These keywords will be used for indexing purposes

Abbreviations

Define abbreviations that are not standard in this field in a footnote to be placed on the first page of the article. Such abbreviations that are unavoidable in the abstract must be defined at their first mention there, as well as in the footnote. Ensure consistency of abbreviations throughout the article.

Acknowledgements

Collate acknowledgements in a separate section at the end of the article before the references and do not, therefore, include them on the title page, as a footnote to the title or otherwise. List here those individuals who provided help during the research (e.g., providing language help, writing assistance or proof reading the article, etc.).

Math formulae

Present simple formulae in the line of normal text where possible and use the solidus (/) instead of a horizontal line for small fractional terms, e.g., X/Y. In principle, variables are to be presented in italics. Powers of e are often more conveniently denoted by exp. Number consecutively any equations that have to be displayed separately from the text (if referred to explicitly in the text).

Footnotes

Footnotes should be used sparingly. Number them consecutively throughout the article, using superscript Arabic numbers. Many wordprocessors build footnotes into the text, and this feature may be used. Should this not be the case, indicate the position of footnotes in the text and present the footnotes themselves separately at the end of the article. Do not include footnotes in the Reference list.

Table footnotes

Indicate each footnote in a table with a superscript lowercase letter.

Artwork

Electronic artwork

General points

- Make sure you use uniform lettering and sizing of your original artwork.
- Embed the used fonts if the application provides that option.
- Aim to use the following fonts in your illustrations: Arial, Courier, Times New Roman, Symbol, or use fonts that look similar.
- Number the illustrations according to their sequence in the text.
- Use a logical naming convention for your artwork files.
- Provide captions to illustrations separately.
- Size the illustrations close to the desired dimensions of the printed version.
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Regardless of the application used other than Microsoft Office, when your electronic artwork is finalized, please 'Save as' or convert the images to one of the following formats (note the resolution requirements for line drawings, halftones, and line/halftone combinations given below): EPS (or PDF): Vector drawings, embed all used fonts. TIFF (or JPEG): Color or grayscale photographs (halftones), keep to a minimum of 300 dpi. TIFF (or JPEG): Bitmapped (pure black & white pixels) line drawings, keep to a minimum of 1000 dpi. TIFF (or JPEG): Combinations bitmapped line/half-tone (color or grayscale), keep to a minimum of 500 dpi.

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Tables

Number tables consecutively in accordance with their appearance in the text. Place footnotes to tables below the table body and indicate them with superscript lowercase letters. Avoid vertical rules. Be sparing in the use of tables and ensure that the data presented in tables do not duplicate results described elsewhere in the article.

References

Citation in text

Please ensure that every reference cited in the text is also present in the reference list (and vice versa). Any references cited in the abstract must be given in full. Unpublished results and personal communications are not recommended in the reference list, but may be mentioned in the text. If these references are included in the reference list they should follow the standard reference style of the journal and should include a substitution of the publication date with either 'Unpublished results' or 'Personal

communication'. Citation of a reference as 'in press' implies that the item has been accepted for publication.

Web references

As a minimum, the full URL should be given and the date when the reference was last accessed. Any further information, if known (DOI, author names, dates, reference to a source publication, etc.), should also be given. Web references can be listed separately (e.g., after the reference list) under a different heading if desired, or can be included in the reference list.

References in a special issue

Please ensure that the words 'this issue' are added to any references in the list (and any citations in the text) to other articles in the same Special Issue.

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This journal has standard templates available in key reference management packages EndNote (<http://www.endnote.com/support/enstyles.asp>) and Reference Manager (<http://refman.com/support/rmstyles.asp>). Using plug-ins to wordprocessing packages, authors only need to select the appropriate journal template when preparing their article and the list of references and citations to these will be formatted according to the journal style which is described below.

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Text: Citations in the text should follow the referencing style used by the American Psychological Association. You are referred to the Publication Manual of the American Psychological Association, Sixth Edition, ISBN 978-1-4338-0561-5, copies of which may be ordered from <http://books.apa.org/books.cfm?id=4200067> or APA Order Dept., P.O.B. 2710, Hyattsville, MD 20784, USA or APA, 3 Henrietta Street, London, WC3E 8LU, UK.

List: references should be arranged first alphabetically and then further sorted chronologically if necessary. More than one reference from the same author(s) in the same year must be identified by the letters 'a', 'b', 'c', etc., placed after the year of publication.

Examples:

Reference to a journal publication:

Van der Geer, J., Hanraads, J. A. J., & Lupton, R. A. (2010). The art of writing a scientific article. *Journal of Scientific Communications*, 163, 51–59.

Reference to a book:

Strunk, W., Jr., & White, E. B. (2000). *The elements of style*. (4th ed.). New York: Longman, (Chapter 4).

Reference to a chapter in an edited book:

Mettam, G. R., & Adams, L. B. (2009). How to prepare an electronic version of your article. In B. S. Jones, & R. Z. Smith (Eds.), *Introduction to the electronic age* (pp. 281–304). New York: E-Publishing Inc.

Journal abbreviations source

Journal names should be abbreviated according to:

List of title word abbreviations: <http://www.issn.org/2-22661-LTWA-online.php>; NLM Catalog (Journals referenced in the NCBI Databases): <http://www.ncbi.nlm.nih.gov/nlmcatalog/journals>; CAS (Chemical Abstracts Service): via <http://www.cas.org/content/references/corejournals>.

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One author has been designated as the corresponding author with contact details:

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All necessary files have been uploaded, and contain:

- Keywords
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Further considerations

- Manuscript has been 'spell-checked' and 'grammar-checked'
- References are in the correct format for this journal
- All references mentioned in the Reference list are cited in the text, and vice versa
- Permission has been obtained for use of copyrighted material from other sources (including the Web)
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